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ESTIMATION AND ANALYSIS OF MANAGEMENT OPPORTUNITIES FOR DEVELOPED RECREATION IN THE NORTHERN REGION

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Final Report

Estimation and Analysis of Management Opportunities for Developed Recreation in the Northern Region

submitted to:

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Summary of Major Conclusions

This study describes the existing treatment opportunities for developed recreation in the Northern Region, USFS, and analyzes in detail the costs of managing them.

The major findings are:

1. Average costs were calculated by development/experience level for both family campgrounds and family picnicgrounds. These range from $3,800 to $30,000 annually per site or from $3.00 to $15.00 per visitor day.
2. Average costs were also calculated for boating and swimming sites, group campgrounds, group picnicgrounds, major and minor interpretive sites, observation sites, and documentary sites. Costs ranged from $3,000 to $70,000 annually per site and from $2.00 to $9.00 per visitor day.
3. Some types of developed recreation cost more per site while being cheaper on a visitor-day basis. This is because some areas are used more near capacity.
4. Cost functions were estimated to help describe what factors affect cost and by how much. Variables found significant were: persons-at-one-time capacity, amount of use, type of recreation site, development/experience level, geographic location, remoteness, length of season, and whether or not a fee was charged.
5. Most developed recreation sites in the Northern Region were used below the point where the cost per recreation visitor day is a minimum.
6. The revenue from camping fees was compared to the costs of providing family campgrounds. It was found that four to eight percent of total annual costs and 10 to 30 percent of annual operation and maintenance costs were offset by revenue.

7. Contributed and borrowed labor amounts to approximately 28 percent of total annual labor costs in running a developed recreation site. This figure varied from 10 to 40 percent depending on the type of site.
8. Real costs of constructing USFS developed recreation sites have not changed significantly since about 1959.
9. Estimates of operation and maintenance costs from this study are more complete than any available through regular USFS accounting records. A test showed that our costs were higher than those from the PAMARS system.

INTRODUCTION

In response to the demand for outdoor recreation, resources have been invested to provide campgrounds, boating sites, picnic sites, and interpretive facilities for public use. While these facilities are used by the public, the cost of providing them competes with other resource uses that benefit the public. With increasing pressures of higher energy costs, restricted budgets, and administrative accountability, managers need to use their resources efficiently. To utilize resources efficiently implies some knowledge of costs: the focus of this study.

The notion that costs of providing recreation opportunities should be known to managers is well documented. The Resources Planning Act [1974] calls for the identification of costs and benefits of all such management actions. The National Forest Management Act [1976] further elaborates on the identification of costs. These and other directives together with the lack of existing information partially provide the basis for the research work unit within the Intermountain Forest and Range Experiment Station US Forest Service (FS-INT-4201, Economics of Multiple Use Management on Public Forest Lands). Of the three problems assigned this research unit, the second deals with costs of providing recreation: "The costs of alternative management practices designed to produce non-commodity resources are not well enough defined to ensure that land and other production resources are efficiently allocated." Along with others, one research objective to be met is to define the "...direct investment costs of providing opportunities for developed, dispersed, and wilderness recreation." This research responded to that objective, focusing on costs of developed recreation opportunities in the Northern Region, USFS.

Objectives

In general, this study is designed to provide USFS recreation managers current cost estimates of developed recreation areas, and models to predict these costs in the future, in the Northern Region. More specifically, the objectives are as follows:

1. To identify and describe the major and non-major management treatment opportunities available to promote developed recreation in the Northern Region.

   These were classified into campgrounds, picnicgrounds, boating sites, swimming sites, interpretive sites (major and minor), information sites, documentary sites, and observation sites. The number of areas of each type were identified by four geographical zones within the Northern Region.

2. To identify and describe treatment units, major cost activities, and expected treatment outputs associated with the major treatment opportunities for 1980.

   Average costs were estimated for each of three cost categories: (1) planning, (2) facilities, and (3) operation and maintenance. Results were stratified by development level, where possible, and presented as regional averages per treatment opportunity, treatment unit, and treatment output.

3. To empirically estimate total and average cost as related to scale of development, treatment units (size), and to the extent feasible, situational conditions associated with major treatment opportunities.

4. To empirically estimate, where possible, any changes in the real cost over time of providing the major treatment opportunities.

Study Area

The study area for this project is Region One (Northern region) of the Forest Service. Region One includes 13 National Forests[1] and 75 Ranger Districts in Eastern Washington, Northern Idaho, Montana, and North and South Dakota. This includes the Little Missouri, Cedar River, Grand River, and Cheyenne National Grasslands of North and South Dakota, which are managed as part of the Custer National Forest.

As would be expected for an area covering parts of 5 large states, the Northern Region has a diverse geographical setting and offers many recreation opportunities. In Northern Idaho and Northwestern Montana temperatures are relatively moderate, being influenced by marine air from the Pacific Ocean. Although the topography is hilly or mountainous, valley elevations are less that 3,000 feet. The timber resource is rich with ponderosa, white, and lodgepole pine, alpine and Douglas fir, cedar, and spruce offering recreation visitors densely forested settings.

In the Rocky Mountains of Central Montana, the climate is influenced by a combination of coastal and interior weather patterns. Valley floors may be 5,000 feet and mountain peaks may be over 12,000 feet in elevation, providing the recreationist with true alpine conditions. Snow fall is not unusual during any month of the year at these higher elevations.

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[1] Actually there are 15 National Forests when the Idaho Panhandle National Forests are taken individually. These three Forests are managed through one Supervisor's Office, however, and will be considered as one Forest throughout this report.

East of the Rockies, Montana and the Dakotas are characterized by grasses and ponderosa pine among vast prairies and rolling hills. This is a dryer and harsher climate, predominantly influenced by interior weather patterns. Temperatures are more extreme than in the western part of the Region. Forest and Grassland visitors to this area will experience the "wide open spaces" associated with the American West.

All these varied conditions and settings of the Northern Region combine to form an immense recreational resource. Developed recreation facilities in every National Forest and Ranger District greatly enhance this resource. These facilities provide opportunity for many kinds of recreation experiences. Visitors may choose facilities ranging from primitive, offering little interaction among other people, to modern, offering comfort, convenience, and substantial interaction with others.

PROVISION OF DEVELOPED RECREATION

To help conceptualize the provision of developed recreation, the Recreation Production/Consumption System model developed by King and Dyer (1980) will be modified and adopted. To do this, it is important to distinguish between the recreation engagement and the recreation experience. The recreation engagement is the act or behavior of recreating. The recreation experience is the psychological and physiological result from a recreation engagement (Brown et al. 1979).

The producer of developed recreation opportunities, in this case, is the USFS. The USFS, or manager, utilizes land, water, and capital inputs in producing opportunities for users to engage in developed recreation. These opportunities have physical characteristics such as lakes, clean air, and trees; managerial characteristics including, but not limited to, actual developed facilities; and social characteristics such as the opportunity to interact with other visitors. Box 1 of Figure 1 represents the developed recreation opportunity production process. The opportunity output produced by this process is measured by persons at one time capacity (PAOT).

PAOT (the treatment unit common to all developed site types) represents the number of people who could simultaneously recreate at a site, according to its design and facilities. As a treatment unit, both the number of PAOT's provided and the management practices used in their provision can be controlled by the recreation manager. The number of PAOT's provided can be altered by opening or closing certain sections within sites during the managed season, or in the long run, by constructing new sites.

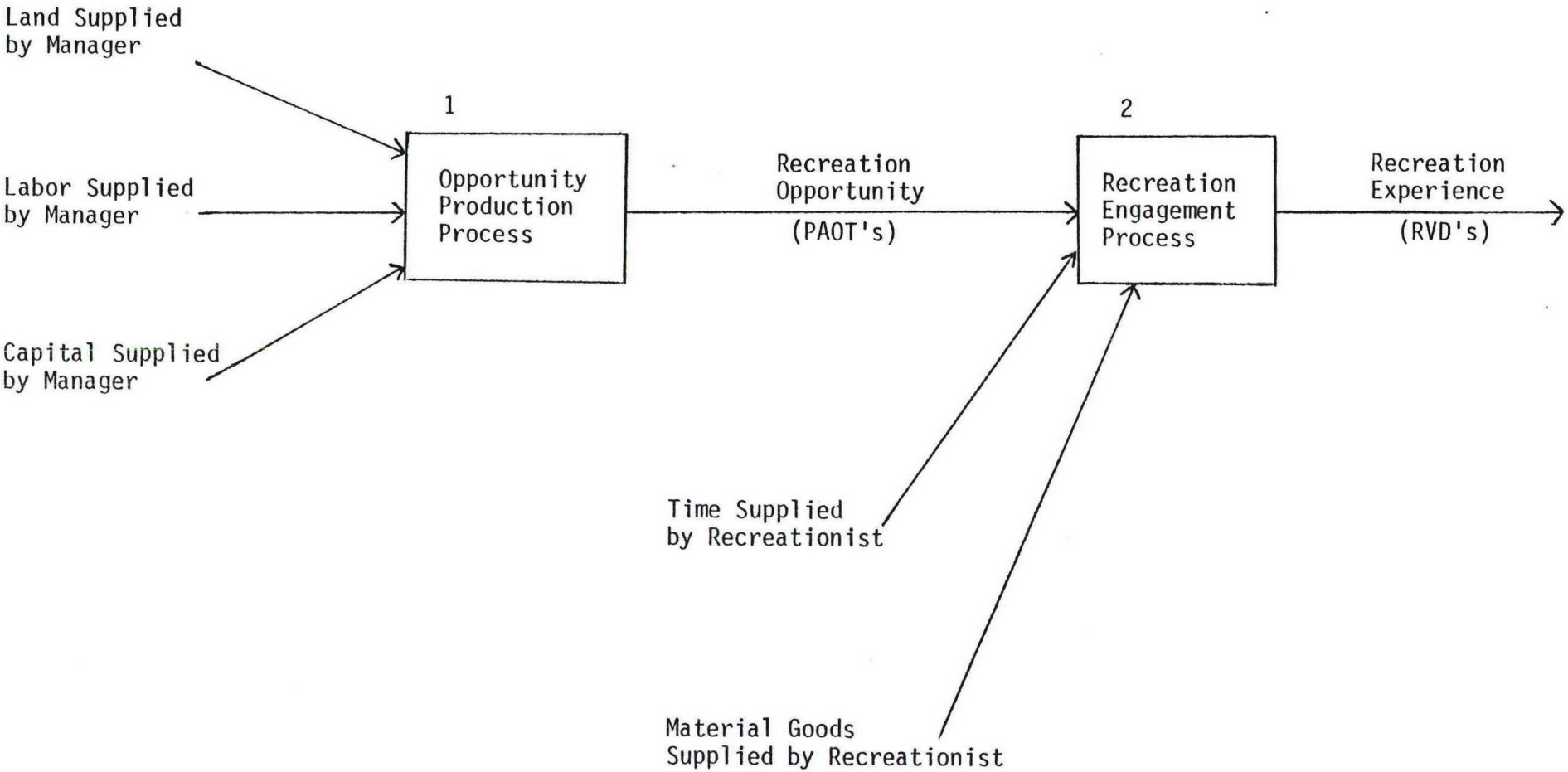

Figure 1.

Production/Consumption Processes
for Developed Recreation

To engage in developed recreation, the National Forest visitor must provide time and material goods inputs, and combine them with the USFS produced recreation opportunities. Box 2 of Figure 1 represents the process of engagement in developed recreation. The end result of this process is the developed recreation experience measured by recreation visitor-days of use (RVD).

A RVD (treatment output measuring developed recreation experience) is defined as 12 visitor hours spent in any activity, except those which are a part of or incidental to the pursuit of a gainful occupation. The 12 hours may be aggregated continuously, intermittently, or simultaneously, by one or more persons. In other words, one RVD may represent six people at a site for 2 hours, one person at a site for 12 hours, three people making two trips of 2 hours each, or any combination. Output levels will depend upon the capacity and type of the site along with various situational conditions.

According to King and Dyer (1980), the recreation engagement "...may be viewed either as a production process or a consumption process resulting in recreation experiences." The notion of a consumption process comes from the fact that the recreationist has a certain demand for developed recreation and will incur a cost (time and material goods) in order to consume or engage in it. The quantity consumed is determined by the intersection of the recreationist's demand for and the producer's (USFS's) supply of developed recreation opportunity. Consumption, in this case, is the act of recreation engagement and will result in recreation experiences which are the utilities of the process. The supply schedule for developed recreation opportunity (PAOT's) is determined by the marginal cost incurred by the USFS in producing PAOT's. The demand schedule is determined by the costs the recreationist must incur to engage in developed recreation. Much research effort has recently been

applied to understanding and estimating the demand for outdoor recreation.

As mentioned above, recreation engagement may also be considered a production process. Since several inputs must be combined before the engagement can occur, this viewpoint may have more intuitive appeal. In this case, the developed recreation experience is the final output of a two stage production process. In the first stage, the USFS combines land, labor, and capital to produce PAOT's. The quantities of these inputs that can be purchased at different budget levels are represented by a series of isocost lines of the form:

$$TC = Q_y P_y + Q_x P_x + Q_z P_z \qquad (1)$$

where: TC is the budget level or total amount on inputs,

Q_y, Q_x, and Q_z are the quantities purchased of inputs Y, X, and Z, and

P_y, P_x, and P_z are the unit prices of inputs Y, X, and Z.

Current levels of technology determine a series of production isoquants giving the maximum amounts of PAOT output that can be produced with different combinations of input quantities. The points of tangency between the isocost lines and isoquant curves determine an expansion path for the production of PAOT. Every point along the expansion path satisfies the condition:

$$\frac{MP_y}{P_y} = \frac{MP_x}{P_x} = \frac{MP_z}{P_z} \qquad (2)$$

where: MP_y, MP_x, and MP_z are the marginal products of inputs Y, X, and Z in the production of PAOT's.

The expansion path gives the most efficient combination of inputs for each production level and thus, can also be considered the production function for PAOT's. The cost function for the production of PAOT's can be directly de-

rived by multiplying the input quantities by their corresponding unit prices. This manipulation simply relates output to cost rather than quantities of inputs.

In the second stage of producing developed recreation experience, the manager and the recreationist come together in a joint production process. Now the PAOT's produced as an output in stage one are used as an input and combined with the other inputs, time and material goods. The unit price of the PAOT inputs is the average cost incurred in producing them. In other words, the USFS produces PAOT's and then buys them back from itself at cost, as when a farmer feeds self grown hay or grain to his cattle. In this sense, the cost function, theoretically derived above, becomes a budget constraint curve showing the different amounts of PAOT inputs that the Forest Service could purchase under different budgets. The price of the time input would be measured in terms of opportunity costs such as foregone wages and salaries. Markets determine the prices paid by the recreationist for the material good inputs. As in the PAOT production process, these inputs are combined in varying quantities according to their prices and marginal products and determine production function for recreation experience as measured by RVD's. This production function may, again, be converted into a cost function by multiplying the input quantities by their corresponding unit prices.

It has been shown how developed recreation may be viewed either as a production - consumption process or a two stage production process. The objectives of this research called for an investigation of USFS incurred and contributed costs associated with developed recreation. When considering the production - consumption process, relating USFS cost as to PAOT's will determine a cost of production relationship. Relating cost to RVD's will determine

a cost of goods sold function, since the amount of consumption is the quantity purchased by the recreationist (consumer) from the USFS (producer). Regarding the two stage production process, relating cost to PAOT's will detemine either a cost of production relationship or a budget constraint line, depending on which production stage is being considered. Relating cost to RVD's, will determine a cost of production relationship but only for the USFS supplied PAOT input. This is because costs associated with the recreationist supplied inputs have not been measured. Thus, this would be a cost function for the manager's contribution to the developed recreation experience.

Whether costs should be related to PAOT's or RVD's is a matter of how the cost information is to be used. The production of PAOT's might be the most relevant from a recreation manager's standpoint because PAOT is the treatment unit and as such, is more under the control of the manager. On the other hand, costs as a function of RVD's may be desired to make a comparison with user benefit estimates in a benefit-cost analysis for resource allocation decisions. In this study both PAOT and RVD cost relationships have been analyzed. It should be noted that because there are two separate processes involved, the RVD and PAOT cost functions may be quite different. One is not merely a multiple of the other.

INVENTORY AND SAMPLE OF NORTHERN REGION DEVELOPED RECREATION

A varied assortment of developed recreation opportunities exist in the Northern Region. The Forest Service Manual (FSM-Title 2300) defines existing developed sites as consisting of "modifications to enhance recreation opportunities in addition to the land, water, and vegetation." The amount of modification at a site may range from a development/experience level 1 (little modification from the natural) to a development/experience level 5 (high degree of modification dominating the natural). However, all operating Northern Region sites are listed experience levels 2, 3, or 4. Appendix A contains a definition of the development/experience levels.

Modifications and improvements may have been made at a location not considered to be a developed recreation site. Toilets, garbage containers, parking spaces, and signs at trail heads are typical examples. To differentiate between developed sites and facility installations on dispersed areas, FSM-Title 2300 gives the following criteria:

1. A developed site has been modified to accommodate one or more specific recreation opportunities for intensive rather than dispersed uses. Modification must include a facilty installation.

2. At developed sites the modifications are to enhance recreation opportunities, and not merely those needed for resource protection or to satisfy administrative needs.

3. Developed sites are documented by approved site designs (FSM 2330.3).

4. For developed sites it is desirable to publish locative and other site information in directories and on maps to help people find the sites and to encourage continued or additional use.

This study dealt with developed sites owned and operated by the Forest Service for the primary purpose of providing recreation to the general public. This definition encompasses sites classified as campgrounds/picnicgrounds

(family and group), boating sites, interpretive sites (major and minor), information sites, documentary sites, and observation sites. The US Forest Service's recreation information management system (RIM) identifies several different types of developed sites that do not fall under the above definition. Recreation residences and organization camps are not open to the general public; winter sports areas, lodges, resorts, and other concessions are operated by private firms (special use permits); and administrative interpretive sites do not exist for the primary purpose of directly providing recreation. These site types were not considered by this project.

Treatment Opportunities in the Northern Region

In most cases the classification of sites (see Table 1) describes the type of recreation activity for which the site is designed. Obviously, the nature of the facilities installed depends on the type of activity to be pursued at a site. Family campgrounds are designed for overnight use by individuals or family-sized groups and usually include tables, fireplaces, tent pads, garbage containers, and toilets around individual parking spurs. Family picnicgrounds are primarily designed for day use and include facilities similar to that of campgrounds but without tent pads and individual spurs for cars and trailers. Group campgrounds and picnicgrounds are similar to their family counterparts except that the size and arrangement of facilities is designed to accommodate larger groups. There is often a reservation system for the use of group sites.

Boating sites typically include ramps, docks, parking, picnicking, and safety facilities necessary for the use of boats. Swimming sites have sanitation and safety modifications for swimmers and in addition, may include park-

TABLE 1. DEVELOPED RECREATION TREATMENT OPPORTUNITIES

AVAILABLE IN THE NORTHERN REGION, USFS, 1980.

Site Classification	Northern Idaho		Mont. West of the Cont. Divide		Rocky Mtns. East of the Cont. Divide		Eastern Mont. and the Dakotas		Northern Region Total		PAOTs per Site
	Number of Sites	Number of PAOTs	Number of Sites	Number of PAOTs	Number of Sites	Number of PAOTs	Number of Sites	Number of PAOTs	Number of Sites	Number of PAOTs	
Family Campground EL2[a/]	25	570	25	525	22	530	0	0	72	1,625	23
Family Campground EL3	73	5,260	81	6,330	94	7,576	10	440	258	19,606	76
Family Campground EL4	3	250	8	1,545	2	220	1	185	14	2,200	157
Family Picnicground EL2	2	45	3	70	4	75	1	20	10	210	21
Family Picnicground EL3	13	425	26	1,477	22	1,049	2	105	63	3,056	48
Family Picnicground EL4	2	275	2	250	2	65	0	0	6	590	98
Boating Site	7	428	37	3,014	15	1,075	0	0	59	4,517	76
Swimming Site	6	425	12	1,320	1	50	0	0	19	1,795	94
Interp. Minor	4	95	2	100	10	965	1	15	17	1,175	69
Interp. Major	1	120	1	100	1	175	0	0	3	395	132
Information Site	1	90	0	0	0	0	0	0	1	90	90
Documentary	6	176	0	0	1	20	0	0	7	196	28
Observation	3	55	3	185	3	280	1	50	10	570	57
Group Campground	0	0	2	250	1	200	0	0	3	450	150
Group Picnicground	4	736	5	1,015	4	208	0	0	13	1,959	151
All Sites	152[b/]	9,048	207	16,181	182	12,488	16	815	557	38,532	69

[a/] EL refers to experience level.

[b/] Includes 1 Family Campground (70 PAOTs) and 1 Family Picnicground (28 PAOTs) with no Experience Level listing.

ing, picnicking, and bathhouse facilities.

A major interpretive site usually includes a separate building where environmental awareness and other educational programs are conducted. A minor interpretive site is designed for the same purposes but without a separate building. Documentary sites include minor facilities for preserving natural or cultural history. Observation sites entail modifications for facilitating or improving natural overlooks and scenic viewing. Information sites usually include some interpretive facilities with a primary purpose of orienting recreationists to the immediate or local area. The RIM Handbook (FSH 2309.11) gives additional description of the various Forest Service developed site kinds.

Four zones were chosen to better represent the number and distribution of developed recreation opportunities in the Northern Region. Definitions for the zones are:

Northern Idaho -

> All Ranger Districts in the Idaho Panhandle, Clearwater, and Nezperce National Forests.

Montana West of the Continental Divide -

> All Ranger Districts in the Bitterroot, Flathead, Kootenai, Lolo, and Deerlodge National Forests except the Jefferson R.D.

Rocky Mountain East of the Continental Divide -

> All Ranger Districts in the Beaverhead, Gallatin, Helena, and Lewis and Clark National Forests plus the Beartooth Ranger District of the Custer National Forest and the Jefferson Ranger District of the Deerlodge National Forest.

Eastern Montana and the Dakotas -

> All Ranger Districts in the Custer National Forest except the Beartooth R.D.

These zones subdivide the Northern Region into units of more comprehensible size. They were designed to account for major geographic and climatic differ-

ences within the Region.

The columns in Table 1 identify the number and distribution of different types of recreation sites within each zone and the Northern Region. This table was derived from the RIM Alphabetical Site Index for developed sites in Region 1. Campgrounds and picnicgrounds were subcategorized by development/experience level. Other site types were not subcategorized because few are categorized. Comparing the PAOT capacities shown in adjacent columns reflects the actual number of treatment units available for each type of treatment opportunity. The PAOT per size figures in the right most column give a notion of the typical size for different site types. For camp- and picnicgrounds, one family unit is usually considered equivalent to 5 PAOT's of capacity.

Table 1 shows that the developed facilities in the Northern Region are designed to provide a variety of recreation to thousands of people at the same time. It also gives an indication of the size and complexity of the related management task.

Sampling Procedure

Because there are so many (557) developed recreation sites in the Northern Region, it was determined that a statistically sound sample would be the most efficient means to analyze costs. To determine sample size, the regional totals for each type of recreation site were used to provide information for sampling rates. Sampling rates varied inversely with the number of sites in each site type. Treatment opportunities other than family camp- and picnicgrounds were not separated into experience levels for sampling purposes because the experience level information was incomplete.

Level three campgrounds (EL_3), which are relatively numerous, had a sam-

pling rate of 1 out of 3. All others were sampled by choosing either every one or one out of two. A more intensive sample was drawn from recreation sites fewer in number so a large enough sample size would be obtained to be meaningful. If a sampling rate of one out of one or one out of two were used for experience level three campgrounds, on the other hand, an unnecessarily large sample of these sites would be drawn. It would be more meaningful to put the additional research resources into analyzing the recreation sites with fewer representatives.

Ranger Districts were chosen by including all districts containing one or more recreation areas of a type to be sampled with a 1/1 ratio. Among these Ranger Districts, the number of recreation sites for the remaining recreation opportunities was calculated. If additional recreation sites were needed to satisfy the desired sample size, an additional Ranger District was randomly drawn. In total, thirty Ranger Districts were selected as part of the sample.

After having determined the types and numbers of recreation sites to be sampled per Ranger District, specific recreation sites were randomly drawn from the RIM's Alphabetical Site Index listing. The sample consisted of 269 developed recreation sites of various types.

During the data collection process several sites were deleted from the sample. This was done since some sites in the sample were found to be closed, some were still under construction, and one had not yet been developed. In all, there were 11 sites dropped from the original sample, leaving 258 to use in the analysis (see Table 2 and 3).

Table 2. Sampling Developed Recreation Sites in the Northern Region, 1980.

TYPE OF SITE	REGIONAL TOTAL	SAMPLING RATE (a)	DESIRED SAMPLE	ACTUAL SAMPLE
Family Campground EL2	72	1/2	39	38
Family Campground EL3	258	1/3	95	94
Family Campground EL4	14	1/1	14	14
Family Picnicground EL2	10	1/1	10	10
Family Picnicground EL3	63	1/2	33	31
Family Picnicground EL4	6	1/1	6	6
Boating Site	59	1/2	30	27
Swimming Site	19	1/2	9	9
Interp. Minor	17	1/2	9	7
Interp. Major	3	1/1	3	2
Information Site	1	1/1	1	1
Documentary	7	1/2	4	3
Observation	10	1/2	6	6
Group Campground	3	1/1	3	3
Group Picnicground	13	1/2	7	7
All Sites	557	1/2	269	258

(a) For EL2 and EL3 family campgrounds with relatively large populations, a 10% over-sample was used to compensate for any reclassifications or closures.

Table 3. Geographic Breakdown of Sample of Developed Recreation in the Northern Region, 1980.

TYPE OF SITE	NORTHERN IDAHO	MONTANA W. OF DIVIDE	ROCKY MT. E. OF DIVIDE	E. MONTANA & DAKOTAS	REGIONAL TOTAL
Family Campground EL2	11	14	13	0	38
Family Campground EL3	24	28	40	2	94
Family Campground EL4	3	8	2	1	14
Family Picnicground EL2	2	3	4	1	10
Family Picnicground EL3	3	15	12	1	31
Family Picnicground EL4	2	2	2	0	6
Boating Site	2	20	5	0	27
Swimming Site	3	6	0	0	9
Interp. Minor	0	0	6	1	7
Interp. Major	1	0	1	0	2
Information Site	1	0	0	0	1
Documentary	2	0	1	0	3
Observation	2	2	2	0	6
Group Campground	0	2	1	0	3
Group Picnicground	1	3	3	0	7
All Sites	57	103	92	6	258

DEVELOPED RECREATION COST ACTIVITIES

Cost Categories

There are various cost categories associated with developed recreation in the Northern Region. These activities were categorized as planning, facility, and operation and maintenance costs.

Planning costs consist of time spent by foresters, architects, and engineers prior to actual construction of a site. Most of this time is involved with the design and layout of the site. The design and layout activity will produce a preliminary and final site design and should result in an approved site development plan. Depending on the type of facilities required at the site, there will be additional, more specialized design and layout work. This may be for utility systems; planting of trees, shrubs and/or grass; customized facilities and other detailed designs such as boat ramps, buildings, and amphitheaters.

Facility costs are incurred with the purchase, installation and construction of facilities at developed sites. Developed recreation facilities include items such as picnic tables, toilets, tent pads, signs, fireplaces, interpretive displays, water and sewer systems, boat ramps, parking lots, and roads. The total facility cost for a site is the sum of the current replacement values determined for each facility at the site. This is an estimate of the cost of constructing an identical site at the same location.

Because facilities and design and layout costs occur just once, only a portion should be attributed to any one year. Thus, when considering costs on an annual basis, planning and facility costs should be amortized. Amortization includes the opportunity cost of not using the capital for anything

other than the recreation site.

Operation and maintenance (O&M) costs are the annually reoccuring costs of providing developed recreation. These costs are for personnel, vehicles, contracts, utilities, tools, and materials. Personnel costs include seasonal, temporary, and permanent USFS employees having done work directly related to a site, as well as contributed manpower such as YACC, CETA, and Job Corps. Regular recreation crews and borrowed crews such as fire, timber, or range personnel that worked at developed sites should be included. Vehicle costs include both operation and depreciation charges or rental fees for all vehicles used in connection with the site. Contract costs are any fees paid for the completion of jobs, such as garbage collection, law enforcement, or toilet vault pumping, by personnel outside the USFS. Utility costs include any expenditures for the use of utilities such as water, gas, or electricity. Tool costs are for oil, fuel, maintenance, repair, and replacement of tools used by personnel for developed sites. Material costs are incurred with the purchase of maintenance materials such as lumber, gravel, and paint as well as supply items such as toilet paper, paper towels, and garbage bags. The operation and maintenance cost for a site is the sum of all subcategories of O&M cost. These do not need to be amortized since they are on an annual basis.

Data Collection

Data needs and sources varied by the type of recreation site. Some data were easily obtainable while others were found only by interviewing several people. Since the divergence exists, each category will be discussed in terms of data collection.

Planning Costs

Data for the measurement of planning costs were collected through personal interviews with Northern Regional Office personnel. Costs considered in the interview were those associated with manpower requirements for the actual design, layout, and subsequent field work during the planning stage of a USFS developed recreation site. Costs associated with site selection, review and approval of plans, and administrative overhead were not considered.

The manpower estimates obtained through the interview were measured in man-days. Design and layout time was estimated to vary linearly with the number of family units of capacity at a rate of 15 man-days per 10 family units for campgrounds and 20 family units for picnicgrounds. Beyond 20 family units this rate is decreased by 50 percent.

Since one family unit is generally equivalent to a five PAOT capacity, estimates of manpower requirements can also be expressed on a per PAOT basis. Use of PAOT units is necessary for two reasons. First, the RIM system records site capacity in PAOT units rather than family units. Second, some activity type sites such as boating, swimming, and group sites are not designed with the family unit in mind.

In applying the man-day/PAOT rates, group campgrounds were treated as family campgrounds and group picnicgrounds were treated as family picnicgrounds. Boating and swimming sites were treated as picnic rather than camping areas because, like picnicgrounds, they tend to have less in terms of size and numbers of developed facilities as compared to campgrounds.

Major interpretive sites are typically of a high development scale and, as learned through interviewing planners at the Regional Office, require significantly more planning time per PAOT than even highly developed campgrounds.

Consequently, design and layout estimates are twice the rate per PAOT of campgrounds. This estimate was based on the rate differential between modern campgrounds and highly developed recreation facilities used by the Michigan Department of Natural Resources in their 1978 Construction Costs Summary.

Minor interpretive or passive type sites (interpretive, observation, documentary, etc.) were treated as a separate group in the data collection process. Design and layout were estimated to take 5 man-days per site. The PAOT concept is not as applicable in the planning requirements of these types of sites. Hence, planning costs were estimated on a per site rather than per PAOT basis.

The RIM Facility Condition Record for each site was reviewed to determine if there were facilities that would require additional specialized design and layout work. If a site included a facility that requires extra planning, additional man-days were attached to that site's planning cost on an individual basis. Time requirements for the different types of specialized plans were estimated as:

Utility plan (water, electricity, sewer, etc.) = 5 man-days

Planting plan (trees, grass, shrubs, etc.) = 2 man-days

Facility Plate plans (special customized facilities) = 2 man-days

Detailed Site plan (boat ramps, buildings, etc.) = 5 man-days

These costs were applied "all or none," regardless of the size or type of site. For many sites only pre-designed standard facility plates (diagrams) are used and an additional cost for designing custom facility plates would not be appropriate. The problem is that it would be nearly impossible to detect for which of the sampled sites custom plates had been designed. It was estimated that 80 to 90 percent of Forest Service sites are designed without using custom plates. For

a conservative estimate, 10 percent of two man-days was applied to the computed planning cost of each site for facility plate design.

Once the required man-days were estimated for each site, appropriate wage scales could be applied to compute an actual dollar planning cost. It was found that personnel at grades ranging from GS-4 through GS-11 might be involved in the design and layout process. Portions of the total time required by jobs demanding different skill and GS levels were estimated during the interview. When a job may be filled by personnel at either of two pay scales, the first step of the higher GS grade was taken as a mid-point and used for computing cost. GS grades and steps effective at the beginning of fiscal year 1980 were used in the computations. After considering the type of site, PAOT capacity, and facilities on hand, an estimate of planning cost was computed for each sampled site.

Facility Costs

For the measurement of facilities costs there are two basic data requirements. The first is a list or inventory of all the facilities comprising each sampled site. This information is contained on RIM Facility Condition Records which are maintained for each developed site and updated annually. A printout containing the 1980 reported inventories for all Northern Region recreation facilities was obtained from the Regional Office. The second data requirement for facilities cost measurement is a list of current replacement values for each item that appears on the inventories. No single list was available which gave all of the replacement costs needed. Estimates for most replacement costs, however, were on RIM Special Report No. 31 which gives averages of the reported costs for the eight different condition classes used on RIM

Facility Conditions Records. Condition Class 4 Regional averages were used. Condition Class 4 is the "replace in kind" category representing the recreation manager's best estimate of what it would cost to replace the facility with a new one of the same kind. When this estimate was not available for a facility, estimates were taken from one of several alternative sources. These were the Michigan Department of Natural Resources' 1978 Construction Cost Summary, a May 1980 report from the Denver Service Center Estimating Section of the National Park Service, some actual Forest Service construction contracts for 1979 and 1980, and a small survey of Ranger District recreation managers taken as part of this research effort. These sources were compared to each other and with the RIM Regional averages. Whenever possible, the RIM figures were used because they applied specifically to the facilities at USFS developed recreation sites in the region.

With the replacement costs per unit and inventory for each site on hand, a cost for each kind of facility at a site was calculated by multiplying the cost per unit by the existing inventory of that particular facility. The total replacement value for each site is the sum of all of its individual facility costs.

Amortizing the total replacement values for the different sites to get annual costs requires application of a discount rate to the expected life of the facilities. In the past, the life of USFS developed sites has been assumed to be 20 years (Gibbs 1980). The survey of District recreation managers and discussions with engineers and planners at the Regional Office indicated that many facilities at developed sites last much less than 20 years. To account for this, each type of facility found on the RIM inventories was put into either a short-or long-life category. This allowed amortization over any combination of two life expectancy periods. For most analyses, periods of 10 and 20

years were used along with a 10 percent discount rate. Planning costs were always amortized over the longer of the two life expenctancy periods because major site planning should only occur once prior to original construction.

Operation and Maintenance Costs

Almost all data used in the measurement of operation and maintenance costs were collected through personal interviews with recreation managers at the sampled Ranger Districts. A questionnaire (see Appendix B) was used to coordinate and standardize the interviews as much as possible. For personnel costs, the number of man-hours for each employee or group of employees was estimated. These estimates were usually based on Project Work Plans (Form 1900-4) and the recall of the recreation manager. Applying the appropriate 1980 pay scales (GS grade and step levels) established total salaries for both contributed (man-power programs and borrowed crews) and budgeted personnel.

Vehicle costs were measured by estimating the number of miles each vehicle was driven and the number of months the vehicle was used in connection with sampled developed recreation sites. To these figures, the appropriate 1980 Fixed Use Rates (FUR) and Fixed Ownership Rates (FOR) were applied to get both the operation and depreciation costs for each vehicle. Summing these estimates across all vehicles gave total vehicle cost. FOR and FUR are standard rates for each class or type of vehicle and are updated yearly.

Contracts and amounts paid were usually on record at the Ranger District offices. Contract amounts for cooperative law enforcement with local sheriff offices were often obtained from the corresponding Forest Supervisor's Office. In most cases there were no utility costs associated with the operation and maintenance of developed sites. When utilities were used, the Ranger District

had records of the actual monthly payments. Expenditures for tools and materials were estimated from actual purchase orders, the amounts charged on 1980 PAMARS Project Management Statements, Project Work Plans, and, the recall of the recreation specialist. The estimates for each of these components was added to compute the total operation and maintenance cost for each sampled site.

Although actual records were used as much as possible, in all cases the O&M figures were the recreation manager's "best estimate" of the actual cost incurred. The most difficult part of this process for these managers was estimating costs for individual sites rather than collectively for all the developed sites in the District. No records of actual O&M costs incurred for individual sites are kept by the Forest Service.

Average Costs

To help describe the magnitude of Northern Region developed recreation cost activities, average costs were estimated for the various treatment opportunities. Average cost figures are useful in making comparisons between different site types and experience levels. They can also be used to predict costs for proposed sites or additions to existing sites. Tables 4 through 7 display estimated average costs on a per site, per PAOT, per RVD basis, and in the case of family camp- and picnicgrounds, by experience level. Planning and facilities costs were amortized at 10 percent to allow for comparison and summation with operation and maintenance costs. Averages for each of the subcategories of O&M costs were estimated and displayed separately. Care should be taken not to double count these costs when using these tables, as they are a subdivision rather than an addition to the composite O&M averages. Appendix

Table 4. Average Annual Costs of Family Campgrounds in the Northern Region, 1980 (10%)

	Family Campgrounds			
PER TREATMENT OPPORTUNITY (SITE)	EL2	EL3	EL4	ALL
Annual Planning	60.39	208.15	361.92	183.80
Annual Replacement Value of Facilities	2,392.65	10,051.80	22,696.67	9,263.33
Annual Operation and Maintenance	1,459.18	4,307.05	6,859.86	3,771.60
1. Labor	883.12	2,658.44	4,025.00	2,314.81
- contributed and/or borrowed	241.80	733.72	1,296.33	657.27
- USFS budgeted	641.32	1,924.73	2,728.67	1,657.53
2. Contract	242.78	720.87	1,448.93	659.70
3. Vehicle	211.05	563.74	520.00	463.31
4. Utility	0.00	23.50	111.07	26.04
5. Tools and Materials	122.22	340.50	572.40	304.77
Total	3,912.21	14,458.71	29,464.36	13,008.16
PER TREATMENT UNIT (PAOT)				
Planning	2.58	2.62	2.28	2.58
Replacement Value of Facilities	102.82	127.24	139.84	121.92
Operation and Maintenance	73.23	58.02	45.04	60.95
1. Labor	45.56	36.86	26.84	38.21
- contributed and/or borrowed	13.30	9.65	7.74	10.45
- USFS budgeted	32.27	27.21	19.10	27.76
2. Contract	11.10	9.37	8.65	9.78
3. Vehicle	10.23	7.01	3.79	7.56
4. Utility	0.00	.17	.54	.16
5. Tools and Materials	6.34	4.60	3.75	4.99
Total	178.64	188.01	185.96	185.24
PER TREATMENT OUTPUT (RVD)				
Planning	.05	.08	.05	.07
Replacement Value of Facilities	1.82	3.43	3.22	2.97
Operation and Maintenance	1.07	1.39	.79	1.24
1. Labor	.66	.92	.55	.81
- contributed and/or borrowed	.18	.25	.22	.23
- USFS budgeted	.48	.67	.34	.58
2. Contract	.16	.20	.14	.18
3. Vehicle	.16	.16	.07	.16
4. Utility	.00	.00	.02	.00
5. Tools and Materials	.08	.10	.07	.09
Total	2.94	4.89	3.06	4.18

Table 5. Average Annual Costs of Family Picnicgrounds in the Northern Region, 1980 (10%)

	Family Picnicgrounds			
PER TREATMENT OPPORTUNITY (SITE)	EL2	EL3	EL4	ALL
Annual Planning	24.16	92.69	162.13	88.24
Annual Replacement Value of Facilities	2,760.68	5,171.82	8,531.96	5,137.61
Annual Operation and Maintenance	1,039.11	2,242.37	2,847.33	2,082.38
1. Labor.....	641.11	1,197.93	1,826.50	1,170.44
- contributed and/or borrowed.....	202.67	291.93	554.33	309.07
- USFS budgeted.....	438.78	906.00	1,272.17	861.38
2. Contract.....	143.44	537.20	417.17	442.44
3. Vehicle.....	174.22	294.70	339.33	276.56
4. Utility.....	0.00	8.43	78.00	16.02
5. Tools and Materials.....	80.00	204.10	186.33	176.91
Total	3,823.95	7,506.87	11,541.43	7,308.23
PER TREATMENT UNIT (PAOT)				
Planning	1.18	1.86	1.54	1.68
Replacement Value of Facilities	138.84	105.03	92.05	110.06
Operation and Maintenance	49.81	47.57	32.37	45.99
1. Labor.....	30.61	25.43	20.88	25.86
- contributed and/or borrowed.....	9.66	5.59	8.03	6.73
- USFS budgeted.....	20.95	19.84	12.85	19.13
2. Contract.....	7.32	11.48	4.14	9.67
3. Vehicle.....	8.34	6.13	3.91	6.27
4. Utility.....	0.00	.17	.60	.19
5. Tools and Materials.....	3.53	4.37	2.84	4.00
Total	189.82	154.47	125.96	157.74
PER TREATMENT OUTPUT (RVD)				
Planning	.03	.14	.25	.13
Replacement Value of Facilities	3.22	9.70	11.47	8.64
Operation and Maintenance	1.16	2.22	3.81	2.22
1. Labor.....	.69	1.07	2.44	1.18
- contributed and/or borrowed.....	.25	.28	1.34	.41
- USFS budgeted.....	.44	.79	1.10	.76
2. Contract.....	.18	.61	.74	.54
3. Vehicle.....	.19	.32	.44	.31
4. Utility.....	0.00	0.00	.01	0.00
5. Tools and Materials.....	.10	.21	.18	.18
Total	4.41	12.05	15.52	10.99

Table 6. Average Annual Costs of Various Activity Sites in the Northern Region, 1980 (10%)

PER TREATMENT OPPORTUNITY (SITE)	Boating Sites	Swimming Sites	Group Campgrd.	Group Picnicgrd.
Annual Planning	144.29	151.09	288.21	186.84
Annual Replacement Value of Facilities	6,577.84	5,143.91	4,384.23	13,250.39
Annual Operation and Maintenance	1,407.65	1,554.56	3,036.33	4,631.43
1. Labor	812.96	846.89	1,811.33	2,585.86
- contributed and/or borrowed	197.96	237.67	497.67	879.14
- USFS budgeted	615.00	609.22	1,313.67	1,706.71
2. Contract	250.58	382.11	562.00	817.57
3. Vehicle	167.69	129.00	363.00	739.57
4. Utility	15.73	113.44	0.00	157.14
5. Tools and Materials	154.69	83.11	300.00	331.28
Total	8,267.09	6,849.56	7,708.77	18,068.67
PER TREATMENT UNIT (PAOT)				
Planning	2.08	2.35	1.99	1.53
Replacement Value of Facilities	94.79	64.59	34.50	82.53
Operation and Maintenance	22.68	19.48	22.92	24.89
1. Labor	13.38	10.73	13.50	14.44
- contributed and/or borrowed	2.84	1.94	3.59	5.05
- USFS budgeted	10.54	8.79	9.91	9.39
2. Contract	3.71	4.92	4.22	4.36
3. Vehicle	2.72	1.45	2.67	3.94
4. Utility	.09	1.34	0.00	.48
5. Tools and Materials	2.78	1.04	2.53	1.68
Total	120.97	86.42	59.40	108.96
PER TREATMENT OUTPUT (RVD)				
Planning	.23	.14	.14	.09
Replacement Value of Facilities	8.00	6.36	2.02	5.27
Operation and Maintenance	.93	1.68	1.50	1.89
1. Labor	.52	.99	.92	1.20
- contributed and/or borrowed	.11	.44	.25	.41
- USFS budgeted	.41	.55	.67	.79
2. Contract	.16	.39	.30	.23
3. Vehicle	.13	.19	.15	.33
4. Utility	.01	.03	0.00	.01
5. Tools and Materials	.11	.08	.12	.12
Total	9.17	8.18	3.67	7.26

Table 7. Average Annual Costs of Passive Sites in the Northern Region, 1980 (10%)

PER TREATMENT OPPORTUNITY (SITE)	Interp. Major	Interp. Minor	Observ. Site	Document. Site
Annual Planning	671.11	81.68	49.57	41.82
Annual Replacement Value of Facilities	43,761.10	23,988.85	2,570.58	2,577.58
Annual Operation and Maintenance	25,089.00	1,681.17	988.83	727.33
1. Labor	16,424.00	757.43	478.33	507.67
- contributed and/or borrowed	1,720.00	299.43	95.17	157.00
- USFS budgeted	14,704.00	458.00	383.17	350.67
2. Contract	1,755.00	195.43	270.00	151.00
3. Vehicle	1,422.50	190.71	100.17	38.33
4. Utility	1,700.00	.71	0.00	0.00
5. Tools and Materials	3,787.50	413.83	140.33	30.33
Total	69,521.21	27,101.17	3,608.98	3,346.72
PER TREATMENT UNIT (PAOT)				
Planning	4.64	2.35	1.52	1.86
Replacement Value of Facilities	298.51	257.88	75.41	93.32
Operation and Maintenance	173.10	41.58	25.71	25.82
1. Labor	117.58	23.95	14.80	18.33
- contributed and/or borrowed	14.33	14.80	2.47	5.27
- USFS budgeted	103.24	9.16	12.32	13.10
2. Contract	11.66	5.99	5.92	5.08
3. Vehicle	9.89	3.41	3.17	1.39
4. Utility	11.02	.04	0.00	0.00
5. Tools and Materials	22.95	7.13	1.83	1.01
Total	476.26	167.69	102.64	121.00
PER TREATMENT OUTPUT (RVD)				
Planning	.08	.07	.04	.04
Replacement Value of Facilities	5.39	8.74	3.37	2.70
Operation and Maintenance	3.14	.82	.69	.79
1. Labor	2.16	.61	.30	.55
- contributed and/or borrowed	.28	.41	.06	.17
- USFS budgeted	1.88	.20	.24	.37
2. Contract	.21	.14	.23	.17
3. Vehicle	.18	.08	.09	.04
4. Utility	.19	0.00	0.00	0.00
5. Tools and Materials	.39	.08	.07	.03
Total	8.61	2.22	4.10	3.53

Table 4 through Appendix Table 7 show the corresponding standard deviations of the averages displayed in Table 4 through 7.

Direct comparisons can be made among the columns of each table to observe how costs vary by site types. The average cost for boating sites is higher than for swimming sites. Comparing major cost categories between these two site types shows that planning and O&M costs are actually higher for swimming than boating sites, but boating site facilities costs are high enough to offset this. High facilities costs at boating sites are likely due to expensive boat ramps and large parking lots designed to accomodate both cars and trailers.

When comparing costs between different site types on a per PAOT or per RVD basis, the relative magnitudes may change from those of the per site estimates. This phenomenon appears often in comparing among different experience levels of family camp- and picnicgrounds. It is clear that on a per site basis, all three major categories of cost increase with higher experience levels. This is expected because sites of higher experience levels tend to be larger and have more highly developed facilities. When computed on a per PAOT basis, however, O&M costs increase inversely with experience levels. Although they actually cost more to operate and maintain, sites of higher experience levels tend to have much higher capacities and therefore, lower O&M costs per PAOT. For campgrounds, the replacement value of facilities per PAOT maintains a direct relationship with experience levels, perhaps because higher experience level campgrounds are so much more intensely developed. With picnicgrounds, increases in PAOT capacity dominate the higher degree of site modification so that facility costs per PAOT decrease with higher experience levels.

When comparing costs on a per RVD basis, experience level three (EL_3) campgrounds have the highest costs in all three major categories. The higher

use or output associated with EL_3 campgrounds is not enough to make costs per RVD lower than for EL_2 campgrounds. EL_4 campgrounds, on the other hand, have such high use that average O&M costs per RVD are significantly lower than for even EL_2 campgrounds. For picnicgrounds, the increase in output with higher experience levels is not enough to offset the corresponding increase in costs so that the per RVD figures still vary directly with experience levels for all cost categories.

Average capacity and output help to explain how costs vary on a per site, PAOT, and RVD basis. Table 8 shows average PAOT capacity and 1979 and 1980 average or expected levels of output for each treatment opportunity. Again, separate computations are made for each of the reported experience levels of family camp- and picnicgrounds. These figures display how both capacity and output increase directly with experience level. Comparison between the RVD estimates for 1979 and 1980 shows no definite overall change. While a slight increase is estimated for some site types, a small decrease is estimated for others.

Annual values of both planning and facilities costs vary by the rate of interest used in amortization. Since there is not one correct interest rate to use, Table 9 presents these costs with two additional rates, 4 and 7 percent. It is now possible to substitute any of these values into Tables 4 through 7 to obtain average costs at a different interest rate.

Table 8. Average Capacities and Outputs for Developed Recreation Sites in the Northern Region, 1980

	Capacity PAOT's	1979 Output RVD's	1980 Output RVD's
Family Campgrounds	79.5	5,470	5,678
EL_2	23.5	1,760	1,858
EL_3	89.1	6,267	6,358
EL_4	169.3	10,533	11,693
Family Picnicgrounds	53.5	1,998	1,880
EL_2	20.6	911	1,100
EL_3	54.5	1,763	1,580
EL_4	93.3	4,800	4,550
Boating Sites	88.8	1,700	1,846
Swimming Sites	78.3	1,933	2,144
Group Campgrounds	150.0	2,600	3,167
Group Picnicgrounds	159.3	4,257	3,771
Interp. Major	147.5	5,600	8,350
Interp. Minor	102.1	13,217	11,514
Observation	70.8	2,133	2,050
Documentary	23.3	900	1,067
Information	90.0	3,600	7,100

Table 9. Average Planning and Facilities Replacement Costs Per Treatment Opportunity. Amortized at 4 and 7 percent.

Site Category	4% Planning	4% Facilities	7% Planning	7% Facilities
All Family Campgrounds	115.14	6,012.22	147.70	7,557.75
EL_2	37.83	1,565.77	48.53	1,959.09
EL_3	130.39	6,526.83	167.27	8,202.60
EL_4	226.72	14,678.85	290.84	18,489.42
All Family Picnicgrounds	55.28	3,332.23	70.91	4,190.43
EL_2	15.13	1,767.69	19.41	2,239.29
EL_3	58.06	3,369.34	74.48	4,226.45
EL_4	101.56	5,493.46	130.29	6,937.09
Boating Sites	90.39	4,138.83	115.95	5,295.85
Swimming Sites	94.65	3,276.04	121.42	4,162.82
Group Campgrounds	180.54	2,796.70	231.60	3,550.47
Group Picnicgrounds	117.04	8,523.96	150.15	10,769.40
Interp. Major	420.40	27,547.37	539.29	35,239.07
Interp. Minor	51.17	15,122.64	65.64	19,329.10
Observation Sites	31.05	1,657.17	39.83	2,091.18
Documentary Sites	26.19	1,647.09	33.60	2,088.94

DEVELOPED RECREATION COST FUNCTIONS

The Model

In addition to average values, it may be helpful to be able to determine how costs vary with treatment units, outputs, or situational conditions. To achieve this, a cost function can be estimated where total annual cost is the dependent variable with various independent variables explaining the variation in cost.

A theoretical model was developed to use as a guide in formulating statistical models from which cost functions were estimated. The site types were divided into two categories; activity sites and passive sites. A priori reasoning indicated that sites where visitors physically utilized facilities designed for a specific activity would have different impacts on cost than sites where visitors mainly observed facilities in a passive manner. Activity sites are campgrounds and picnicgrounds (family and group), boating sites, and swimming sites. Passive sites are interpretive type sites including major and minor interpretive sites, documentary sites, observation sites, and information sites. Because of the number and importance of overnight family campgrounds in Region 1, it was decided these sites should be analyzed separately as well as jointly with the other activity types. Another aspect of the model is that costs are related to both PAOT units of capacity and RVD outputs separately. As shown above, the production of PAOT's and RVD's entails two different processes and consequently, the cost relationships associated with them will also be different.

To account for the categorization of sites into activity and passive, the separate analysis of campgrounds, and both the PAOT and RVD outputs, it

was necessary to formulate the model into several different parts. Thus, there are six components to the model. These are:

1) cost as a function of PAOT for activity sites,
2) cost as a function of PAOT for passive sites,
3) cost as a function of PAOT for family campgrounds only,
4) cost as a function of RVD for activity sites,
5) cost as a function of RVD for passive sites, and
6) cost as a function of RVD for family campgrounds only.

The functional forms of these six parts of the theoretical model are:

$$TC = f(PAOT), TYPE_i, EL_j, G_k, R, L), \quad (3)$$

$$TC = f(PAOT), TYPE_i, G_k, R, L), \quad (4)$$

$$TC = f(PAOT), EL_j, G_k, R, L, FNF), \quad (5)$$

$$TC = f(RVD, TYPE_i, EL_j, G_k, R, L), \quad (6)$$

$$TC = f(RVD, TYPE_i, G_k, R, L), \quad (7)$$

$$TC = f(RVD, EL_j, G_k, R, L, FNF), \quad (8)$$

where:

TC = total annual cost

PAOT = persons at one time capacity

RVD = annual recreational visitor days

$TYPE_i$ = dummy variable to indicate the type of site within the major categories

EL_j = dummy variables to indicate the experience level of family campgrounds and picnicgrounds

G_k = dummy variables to indicate in which of the four geographic zones the site is located

R = remoteness from major highways

L = length of managed season

FNF = dummy variable to indicate if a user fee is collected at the site.

Definitions and explanations for the variables included in the model are given below:

Total Annual Cost (TC): Total annual cost is the sum of amortized planning, amortized facilities, and operation and maintenance costs all of which were described above. It is a continuous variable recorded to the nearest dollar.

Persons At One Time Capacity (PAOT): Persons at one time capacity was defined as a measure of developed recreation opportunity. It is hypothesized that all costs (planning, facilities, and operation and maintenance) will vary directly with PAOT capacity. For family camp- and picnicgrounds, 5 PAOT's of capacity are generally equivalent to one family unit of capacity. PAOT will be used as the quantity variable in three of six model components. It is a continuous variable recorded to the nearest integer value (person).

Recreational Visitor Days (RVD): Annual recreational visitor days were defined as a measure of developed recreation experience. Because all of the three major cost categories represent inputs into the production of developed recreation experience, it is hypothesized that total cost will vary directly with RVD. As a measure of output, RVD will be used as the quantity variable in three of the six functional forms of the model. It is a continuous variable recorded to the nearest 100 days.

Type of Site ($TYPE_i$): As shown, developed recreation in the Northern Region is comprised of a number of different site types. The variable $TYPE_i$

should be included in the model because costs may vary among these different types of sites. For activity sites, $TYPE_i$ requires five dummy variables ($i = 2, 3, 4, 5, 6$) to differentiate among campgrounds (family), picnicgrounds (family), boating sites, swimming sites, group campgrounds, and group picnicgrounds. For passive sites, $TYPE_i$ differentiates major interpretive sites from all other interpretive type sites so that only one dummy variable, $TYPE_8$, is required. Possible values of the $TYPE_i$ variable and the corresponding site type follows:

$TYPE_i$	Site Type
	Activity Sites
1	Family Campground
2	Family Picnicground
3	Boating Site
4	Swimming Site
5	Group Campground
6	Group Picnicground
	Passive Sites
7	Major Interpretive
8	Minor Interpretive, Observation Site, Documentary Site, Information Site

All dummy variables used in the model are restricted to the values 0 or 1. $TYPE_i$ equals 1 only when the model is representing the site type labeled i and equals 0 in all other cases. In other words for activity sites, when the model represents boating sites, $TYPE_3 = 1$ and the other $TYPE_i$ variables = 0. When all $TYPE_i$ variables = 0, the model represents family campgrounds.

Experience Level (EL_j): The experience (development level) can be used to further differentiate between recreational experiences offered by the developed recreation sites of the US Forest Service. It is hypothesized that all cost categories (planning, facilities, and operation and maintenance) will increase with higher experience levels, since more facilities and personnel are required to provide the higher levels of experience. Because there were no experience level 1 or 5 sites in Region 1, only three experience levels (2, 3, and 4) are represented in the model. This requires two dummy variables, EL_3, and EL_4. When the value of EL_3 is 1, the model represents experience level 3 sites; when EL_4 equals 1, experience level 4 sites are represented; and when both EL_3 and EL_4 equal 0, experience level 2 sites are represented. It was decided that only family camp- and picnicgrounds should be represented by experience level in the cost model because they are the only site types for which this concept was applied in the sampling process.

Geographical Zone (G_k): The four geographic subregions defined earlier and utilized in sampling were defined largely with respect to climatic differences. Different climatic conditions may require different types or qualities of facilities and affect the corresponding repair and maintenance costs, consequently affecting total cost. Because there were so few sites in the zone comprising Eastern Montana and the Dakotas, that zone was combined with Rocky Mountains East of the Continental Divide. Thus, only two dummy variables, G_2 and G_3 were needed. When G_2 equals 1, Montana West of the Continental Divide is represented; when G_3 equals 1, Northern Idaho is represented; and all territory east of the Continental Divide is represented when both G_2 and G_3 are 0.

Remoteness (R): The remoteness of individual sites is hypothesized to affect costs of providing them to the public both directly and indirectly. Directly, it affects costs by increasing the expense of getting materials and personnel to the site. Indirectly, it affects cost because more remote sites tend to be in more rugged terrain and at higher elevations which could increase costs in much the same manner as climatic conditions of different geographic zones. To account for these factors, the variable R will represent the distance in miles from the site being considered to a "major travel route." "Major route" is defined as US highways and interstate freeways (see Figure 2). R is a continuous variable recorded to the nearest mile.

Length of Season (L): The length of time a recreation site is managed and open for use during the year will affect the cost of providing it. More man-hours, vehicle miles, utilities, tools, etc., will be required the longer the managed season. The variable L is a continuous variable recorded to the nearest week.

Fee/No Fee (FNF): When certain services are provided, the Forest Service may choose to charge a user fee to visitors at that site. It is hypothesized that these sites will tend to have higher costs then those without user fees because fee collection requires additional facilities and/or man-hours. Also, keeping the site in a condition and service level that makes it eligible for charging fees might mean additional facilities and/or operation and maintenance costs. The FNF variable is a dummy variable taking on the value 1 when a fee is charged and 0 when no fee is charged. Typically, user fees are not charged at site types other than family campgrounds and so this variable is included only in the functions specific to campgrounds.

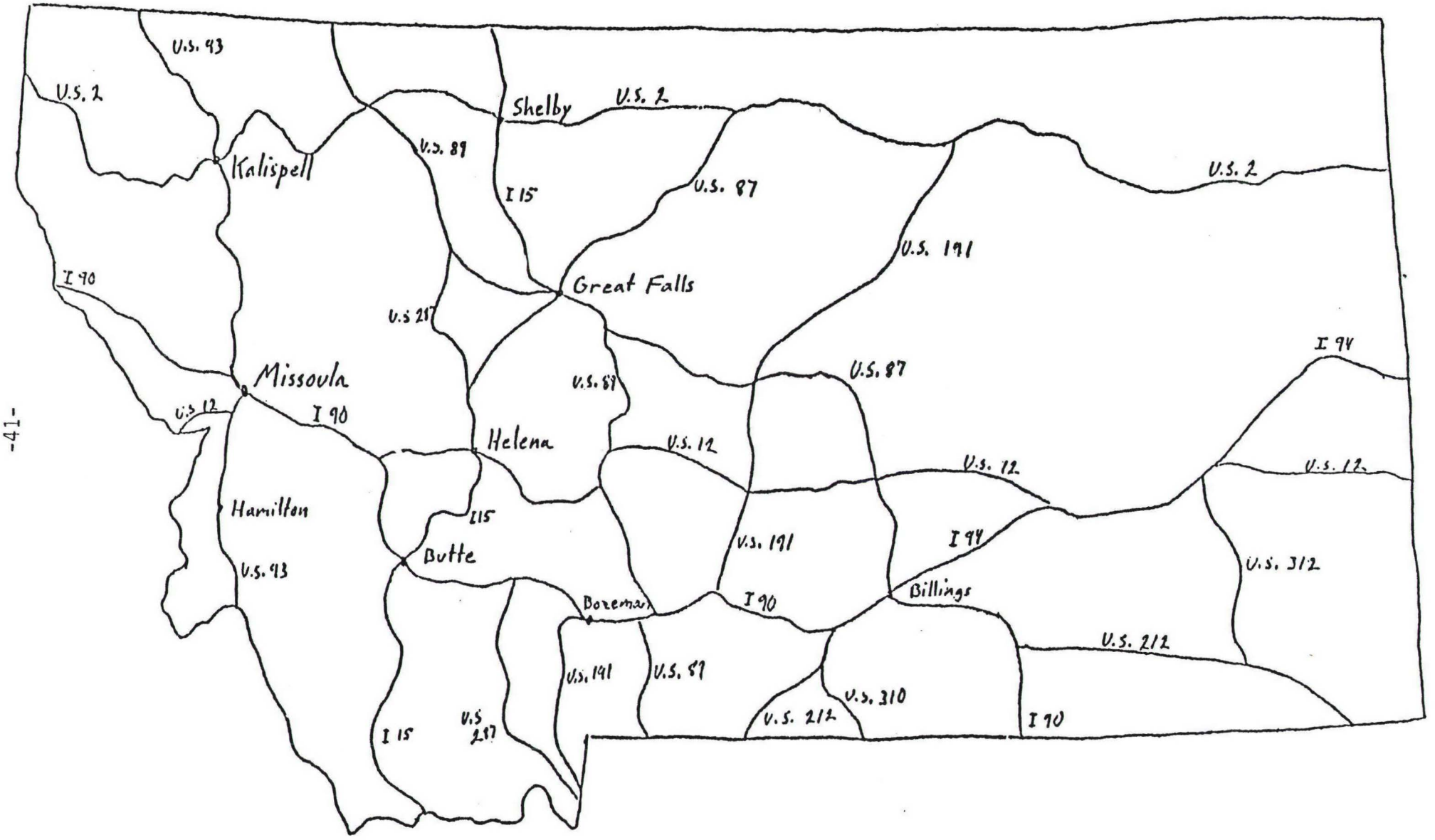

Figure 2. Major Highway Routes in Montana

The nine variables discussed above, when considered in six functional forms, comprise the model developed for investigating cost relationships associated with Northern Region developed recreation. The next step in investigating these relationships is hypothesizing the roles of the independent variables in explaining total cost.

Statistical Model

All the variables in the model discussed above were tested and analyzed using numerous functional formulations. A priori reasoning indicated that the best functional form might be linear, quadratic, or cubic, depending on the range of the data. The classical total cost model is a cubic function with cost increasing at a decreasing rate over the first range of output and then increasing at an increasing rate for all higher levels of output. If the data collected are over a sufficient range of output then this cubic form should be reflected. However, if a narrower range is observed, the data may reflect just the increasing at a decreasing rate or the increasing at an increasing rate portions of the true cost curve. In this case, a quadratic or second degree polynomial would best represent the data. If the squared term has a negative coefficient, the data are over the range where costs are still increasing at a decreasing rate. If the squared term has a positive coefficient, the data are over the range where costs are increasing at an increasing rate. A third case would be if the observations were taken over a range small enough relative to the true cost curve that a linear function best represents the data. This may occur within any portion of the true cost relationship but should always result in a positive coefficient because total costs should always increase with increases in the quantity of output produced. Therefore,

in all six components of the theoretical model, the quantity variable (PAOT or RVD) was tested in linear, quadratic, and cubic form for explaining variation in total cost.

To account for differences in costs among different categories of sites the variables $TYPE_i$ and EL_j were used, as discussed above. These dummy variables, however, only affect the intercept of the cost function causing it to shift up or down depending on sign of the coefficient. When it is desired to account for possible differences in the slope of the cost curve among different site categories, an interaction variable must be used. Interaction variables were formed by multiplying the different dummy variables ($TYPE_2$, $TYPE_3$, EL_3, etc.) by the quantity variable (PAOT or RVD) used in that function. When used, the interaction variable will have an estimated coefficient that can be added to or subtracted from the original slope coefficient. This interaction variable was included and tested in all six components of the model.

After testing all the functional formulations suggested by theory, explicit statistical models were chosen for each of the six model components.

Activity Sites

$$TC = \beta_0 + \beta_1 PAOT + \beta_2 TYPE_2 + \beta_3 TYPE_3 + \beta_4 TYPE_4 + \beta_5 TYPE_6 + \beta_7 T_2 PAOT + \beta_4 T_3 PAOT + \beta_9 T_4 PAOT + \beta_{10} T_6 PAOT + \beta_{11} EL_3 + \beta_{12} EL_4 + \beta_{13} R \quad (9)$$

$$TC = \beta_{24} + \beta_{25} RVD + \beta_{26} (RVD)^2 + \beta_{27} TYPE_2 + \beta_{28} TYPE_3 + \beta_{29} TYPE_4 + \beta_{30} TYPE_6 + \beta_{31} EL_3 + \beta_{32} EL_4 + \beta_{33} L + \beta_{34} G_2 \quad (10)$$

Passive Sites

$$TC = \beta_{14} + \beta_{15}PAOT + \beta_{16}TYPE_8 \tag{11}$$

$$TC = \beta_{35} + \beta_{36}RVD + \beta_{37}(RVD)^2 + \beta_{38}(RVD)^3 + \beta_{39}TYPE_8 \tag{12}$$

$$TC = \beta_{17} + \beta_{18}PAOT + \beta_{19}(PAOT)^2 + \beta_{20}EL_3 + \beta_{21}EL_4 + \beta_{22}R + \beta_{23}FNF \tag{13}$$

$$TC = \beta_{40} + \beta_{41}RVD + \beta_{42}(RVD)^2 + \beta_{43}EL_3 + \beta_{44}EL_4 + \beta_{45}L + \beta_{46}FNF + \beta_{47}G_2 + \beta_{48}G_3 \tag{14}$$

where:

T_2PAOT = dummy interaction variable for picnicgrounds (1 if picnicground, 0 if not)

T_3PAOT = dummy interaction variable for boating sites (1 if boating site, 0 if not)

T_4PAOT = dummy interaction variable for swimming sites (1 if swimming site, 0 if not)

T_6PAOT = dummy interaction variable for group picnicgrounds (1 if group picnicground, 0 if not).

All other variables are as previously defined.

Equation (9) relates total cost to PAOT capacity for activity sites. For this function a linear form was found to best represent the data. Most of the T_iPAOT interaction dummy variables were found to be significant and were included. The interaction variables formed by multiplying EL_j by PAOT were insignificant, however, and so were not maintained in the equation. The variable differentiating group campgrounds was deleted from the model because

there were only three cases and no significant coefficients were obtained. Cost analysis for these sites is limited to the average cost tables given above. The L and G_k variables were excluded from Equation (9) because their coefficients were not found to be significantly different from zero.

Equation (10) relates total cost to RVD's for activity sites. The best representation of the data was a quadratic. No interaction terms were found to be significant but most of the regular $TYPE_i$ and EL_j dummy variables were highly significant. A main difference between the PAOT and RVD models is that the remoteness variable (R) was significant in the former and not in the latter, while the length of season variable (L) was highly significant in the RVD equation but not the PAOT equation. Consequently, in this equation, L was included while R was thrown out. Of the G_k variables only G_2, representing Montana West of the Continental Divide, was significant.

A linear form was found to best represent the relationship between cost and PAOT for passive sites (Equation (11)). The dummy variable for major interpretive sites was found to be highly significant. Dummy variables for other interpretive type sites could not be used because of the small number of observations. The $TYPE_8$ variable was chosen rather than separating out some other passive site type because of knowledge gained through Forest Service personnel that major interpretive sites are more unique and have much higher costs than any of the others. An interaction variable between $TYPE_8$ and PAOT was tested but found to be insignificant and so not included. The variables G_k, R, and L were deleted from this model also because of the small number of degrees of freedom.

The relationship between total cost and RVD for passive sites is shown in Equation (12). As in Equation (11), most variables were deleted because

of the small number of degrees of freedom. Because a cubic form best represented the data, the degrees of freedom problem was even worse. However, the $TYPE_8$ dummy variable was still used because it was highly significant and greatly improved the equation's explanation of total cost.

Equation (13) relates total cost to PAOT for family campgrounds only. In this case a quadratic form allowed the best fit of the data. Interaction terms between EL_j and PAOT were found to be insignificant. As in Equation (9), the G_k and L variables were deleted from the function because their coefficients were found to be insignificant.

Equation (14) relates total cost to RVD for family campgrounds only. As in Equation (10) and (13), the quadratic form was chosen. The EL_j dummy variables were highly significant while the interaction terms between EL_j and RVD were insignificant. This suggests that cost relationships among campgrounds of different experience levels are similar in terms of slope, but different in magnitude. (Gibbs (1980) found the same results when investigating campground costs in Region 6.) For this equation, both G_2 and G_3 were highly significant when used separately but much less significant when both used together. Because there was no theoretical basis for selecting one over the other, both were retained in the model. As in all RVD equations, the R variable was insignificant and excluded from the equation. The fee/no fee variable (FNF) was highly significant.

The explicit statistical model derived above determines the functional form and variables to be included for each of the six model components. From these statistical expressions, regressions were run to estimate coefficients for each variable.

Estimated Model

The final estimated model has six components. Each is a long run total cost function based on standard multiple regression techniques. They are long run functions because the data were taken from sites of all different levels of physical capacity. Planning and facilities costs were amortized at ten percent. The six estimated functions are:[2]

Activity Sites[3]

$$TC = \underset{(1.62)}{-1768.93} + \underset{(19.42)}{129.03}(PAOT) + \underset{(1.16)}{2230.76}(TYPE_2) - \underset{(2.86)}{82.31}(T_2PAOT)$$
$$- \underset{(3.32)}{46.75}(T_3PAOT) - \underset{(1.86)}{46.94}(T_4PAOT) + \underset{(2.63)}{2835.60}(EL_3)$$
$$+ \underset{(3.46)}{6591.15}(EL_4) + \underset{(3.87)}{95.60}(R) \qquad (15)$$

$R^2 = .72$ $\qquad$ $F = 70$ $\qquad$ $d.f. = 222$

$$TC = \underset{(0.54)}{-1135.22} + \underset{(3.55)}{0.85}(RVD) + \underset{(1.83)}{0.000013}(RVD)^2 - \underset{(1.63)}{2426.81}(TYPE_2)$$
$$+ \underset{(0.91)}{1829.93}(TYPE_3) + \underset{(3.33)}{10960.30}(TYPE_6) + \underset{(3.43)}{4838.03}(EL_3)$$
$$+ \underset{(4.15)}{9788.78}(EL_4) + \underset{(1.79)}{193.94}(L) + \underset{(2.70)}{3038.05}(G_2) \qquad (16)$$

$R^2 = .57$ $\qquad$ $F = 33$ $\qquad$ $d.f. = 222$

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[2] The associated Students' t-statistic is linked in parentheses below each regression coefficient. Below each equation, values are listed for R^2 (the percent of variation in cost explained by existing variables), F (a statistic used to test the degree of relation between the dependent and independent variables), and d.f. (the number of degrees of freedom associated with the F-test).

[3] Group campgrounds were excluded from these estimated equations since there were only two of them.

Passive Sites

$$TC = \underset{(1.11)}{-5091.56} + \underset{(6.97)}{256.51(PAOT)} + \underset{(3.36)}{38364.98(TYPE_8)} \qquad (17)$$

$R^2 = .83$ $\qquad$ $F = 37$ $\qquad$ $d.f. = 15$

$$TC = \underset{(.17)}{-680.05} + \underset{(2.44)}{5.16(RVD)} - \underset{(2.86)}{.00052(RVD)^2}$$

$$+ \underset{(3.92)}{.000000016(RVD)^3} + \underset{(6.90)}{56782.05(TYPE_8)} \qquad (18)$$

$R^2 = .94$ $\qquad$ $F = 54$ $\qquad$ $d.f. = 13$

Family Campgrounds

$$TC = \underset{(2.22)}{-3162.63} + \underset{(6.12)}{156.89(PAOT)} - \underset{(1.56)}{.11(PAOT)^2} + \underset{(.97)}{1473.79(EL_3)}$$

$$+ \underset{(1.70)}{4423.61(EL_4)} + \underset{(3.89)}{119.90(R)} + \underset{(2.78)}{4468.02(FNF)} \qquad (19)$$

$R^2 = .76$ $\qquad$ $F = 74$ $\qquad$ $d.f. = 138$

$$TC = \underset{(.54)}{-1400.38} + \underset{(1.43)}{37(RVD)} + \underset{(2.97)}{.000022(RVD)^2}$$

$$+ \underset{(3.01)}{4951.12(EL_3)} + \underset{(3.87)}{10694.48(EL_4)} + \underset{(1.76)}{279.26(L)}$$

$$+ \underset{(.98)}{1485.24(G_2)} - \underset{(1.04)}{1833.80(G_3)} + \underset{(3.78)}{6895.32(FNF)} \qquad (20)$$

$R^2 = .70$ $\qquad$ $F = 39$ $\qquad$ $d.f. = 136$

The coefficients in the above estimated equations indicate the amount by which total cost will change for every unit change in the value of the independent variable. For example, in Equation (15), the term 129.03(PAOT) implies that total cost will increase by $129.03 for each additional PAOT. Dummy variable coefficients show the estimated change in total cost among

different types, experience levels, geographic locations, or fee status of developed recreation sites. For example, in Equation (20), an experience level 3 campground is estimated to cost $4951.12 more than an experience level 2 campground, while an experience level 4 campground is expected to cost $10,694.48 more than an EL_2 campground ceteris paribus. If a campground is located in Northern Idaho (G_3) it is estimated to cost $1833.80 less per year than if it were East of the Continental Divide. Also, campgrounds that charge a user fee should cost $6895.32 more than non-fee campgrounds, according to Equation (20).

The higher the t-value, the more confidence can be placed in the rejection of the hypothesis that the individual coefficients are equal to zero. Coefficients are said to be "significant" when their t-values have shown them to be significantly different from zero. Typically, when a t-value is low the coefficient is assumed to be zero and the variable excluded from the equation. Determining what t-value justifies rejection is a subjective matter. One important consideration, however, is how strongly theory suggests that the variable should be included in the equation. Variables without a theoretical backing should be excluded more readily than variables with a strong theoretical basis such as the quantity of output variable for a total cost function. For this reason, several of the dummy variables with relatively low t-values remained in the equations.

These overall functions can be converted to functions specific to the different site types and experience levels. By placing either a zero or one for the dummy variables, the equations can be altered to represent a desired category. The resulting functions are shown in Table 10. In deriving these

Table 10. Estimated Total Cost for Different Site Types and Categories, US Forest Service, Northern Region, 1980.

	Cost as a Function of PAOT Capacity
Activity Type Sites	
Family Campgrounds	
EL_2	$TC = 202.34 + 129.03(PAOT)$
EL_3	$TC = 3037.94 + 129.03(PAOT)$
EL_4	$TC = 6793.49 + 129.03(PAOT)$
Family Picnicgrounds	
EL_2	$TC = 2433.10 + 46.72(PAOT)$
EL_3	$TC = 5268.70 + 46.72(PAOT)$
EL_4	$TC = 9024.25 + 46.72(PAOT)$
Boating Sites	$TC = 202.34 + 82.28(PAOT)$
Swimming Sites	$TC = 202.34 + 82.09(PAOT)$
Group Picnicgrounds	$TC = 202.34 + 129.03(PAOT)$
Passive Type Sites	
Major Interpretive	$TC = 33273.42 + 256.51(PAOT)$
All Other Interpretive	$TC = -5091.56 + 256.51(PAOT)$
Family Campgrounds	
EL_2	$TC = -566.80 + 156.89(PAOT) - .11(PAOT)^2$
EL_3	$TC = 906.99 + 156.89(PAOT) - .11(PAOT)^2 + 4468.02(FNF)$
EL_4	$TC = 3856.81 + 156.89(PAOT) = .11(PAOT)^2 + 4468.02(FNF)$

Table 10 (con't)

Cost as a Function of RVD's of Use

Activity Type Sites	
Family Campgrounds	
EL_2	$TC = 2115.21 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
EL_3	$TC = 6953.24 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
EL_4	$TC = 11903.94 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
Family Picnicgrounds	
EL_2	$TC = -311.60 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
EL_3	$TC = 4526.43 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
EL_4	$TC = 9477.18 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
Boating Sites	$TC = 3945.14 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
Swimming Sites	$TC = 2115.21 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
Group Picnigrounds	$TC = 13075.51 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2)$
Passive Type Sites	
Major Interpretive	$TC = 56102.00 + 5.16(RVD) - .00052(RVD)^2 + .000000016(RVD)^3$
All Other Interpretive	$TC = -680.05 + 5.16(RVD) - .00052(RVD)^2 + .000000016(RVD)^3$
Family Campgrounds	
EL_2	$TC = 3210.20 + .37(RVD) + .000022(RVD)^2 + 1485.24(G_2) - 1833.80(G_3)$
EL_3	$TC = 8161.32 + .37(RVD) + .000022(RVD)^2 + 1485.24(G_2) -1833.80(G_3) + 6895.32(FNF)$
EL_4	$TC = 13904.68 + .37(RVD) + .000022(RVD)^2 + 1485.24(G_2) - 1833.80(G_3) + 6895.32(FNF)$

equations, the variables R and L have been replaced by their mean values in order to simplify the expressions. Table 11 lists mean values for all variables included in each of the six model components. For the family campground equations, the FNF term has been excluded from the EL_2 functions because fees were not charged at any experience level two campgrounds, so the value of the FNF dummy variable would always be zero.

Graphical representation of the individual equations of Table 10 is given in Figures 3 through 8. In analyzing and comparing these graphs among each other it is important to remember that the PAOT functions represent costs of a different production process than do the RVD functions, and therefore should not necessarily look similar. Also, these functions were estimated from a sample and are reliable only over the range of data represented by the sample. Table 12 gives the ranges of the quantity of output variables (PAOT and RVD) in the collected data. The graphs drawn in Figures 3 through 8 depict the estimated total cost functions over these ranges of output.

Graphical illustration allows a comparison of the linear, quadratic, and cubic functional forms used. Theory says that total cost functions should be increasing over all ranges of output. Figure 5, however, shows the only cubic function to be decreasing over a range of output. This apparent conflict with theory is most likely the result of a small sample where 2 or 3 observations can significantly alter the shape of the whole curve. In this case, several observations had less total cost than those of sampled sites with slightly less recorded use. With only 18 cases, this caused the curve to slope downward over a range. In general though, this estimated total cost function is increasing and should not cause alarm. When linear and quadratic functional forms were applied to these observations, the resulting estimated equations

Table 11. Mean Values for Variables Used in the Six Estimated Total Cost Functions

Variable	PAOT FUNCTIONS			RVD FUNCTIONS		
	Activity Sites	Passive Sites	Family Campgrounds	Activity Sites	Passive Sites	Family Campgrounds
TAC	11,292.41	20,480.23	13,008.16	11,292.41	20,480.23	13,008.16
PAOT	77.93	83.95	79.49			
$PAOT^2$			12,570.78			
RVD				4,328.63	6,310.53	5,677.55
RVD^2				56×10^6	11×10^7	83×10^6
RVD^3					25×10^{11}	
EL_3	.52		.63	.52		.63
EL_4	.09		.10	.09		.10
$TYPE_2$	.19			.19		
$TYPE_3$	.11			.11		
$TYPE_4$	.04			.04		
$TYPE_6$	.03			.03		
$TYPE_8$		.10			.10	
T_2 PAOT	10.21					
T_3 PAOT	10.16					
T_4 PAOT	2.99					
T_6 PAOT	4.72					
FNF			.24			.24
G_2				.42		.35
G_3						.26
R	20.62		21.65			
L				16.76		16.51

Figure 3.

Total Annual Cost as a Function of
PAOT for Non-Campground Activity Sites

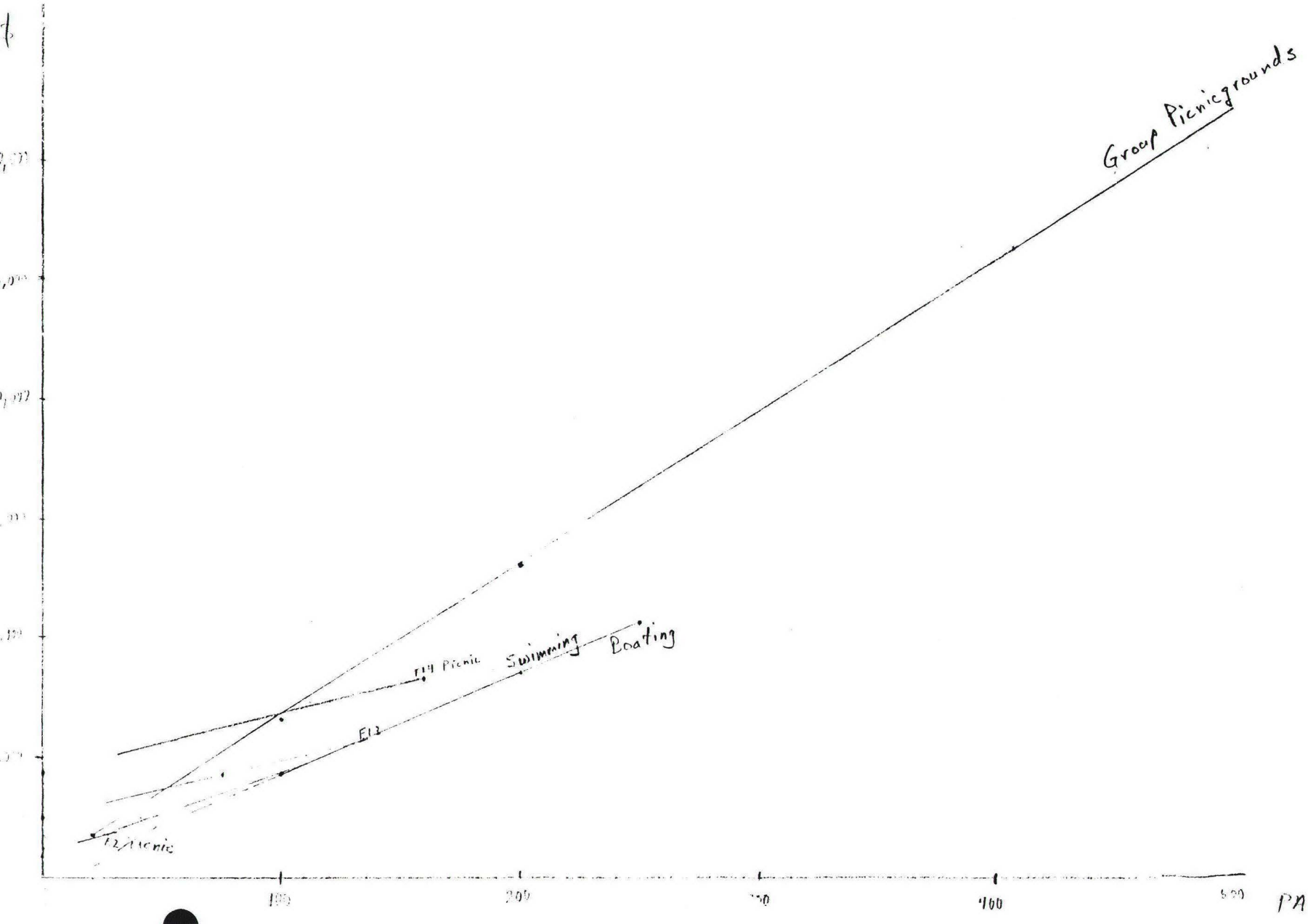


Figure 4.

Total Annual Cost as a Function of RVD
for Non-Campground Activity Sites

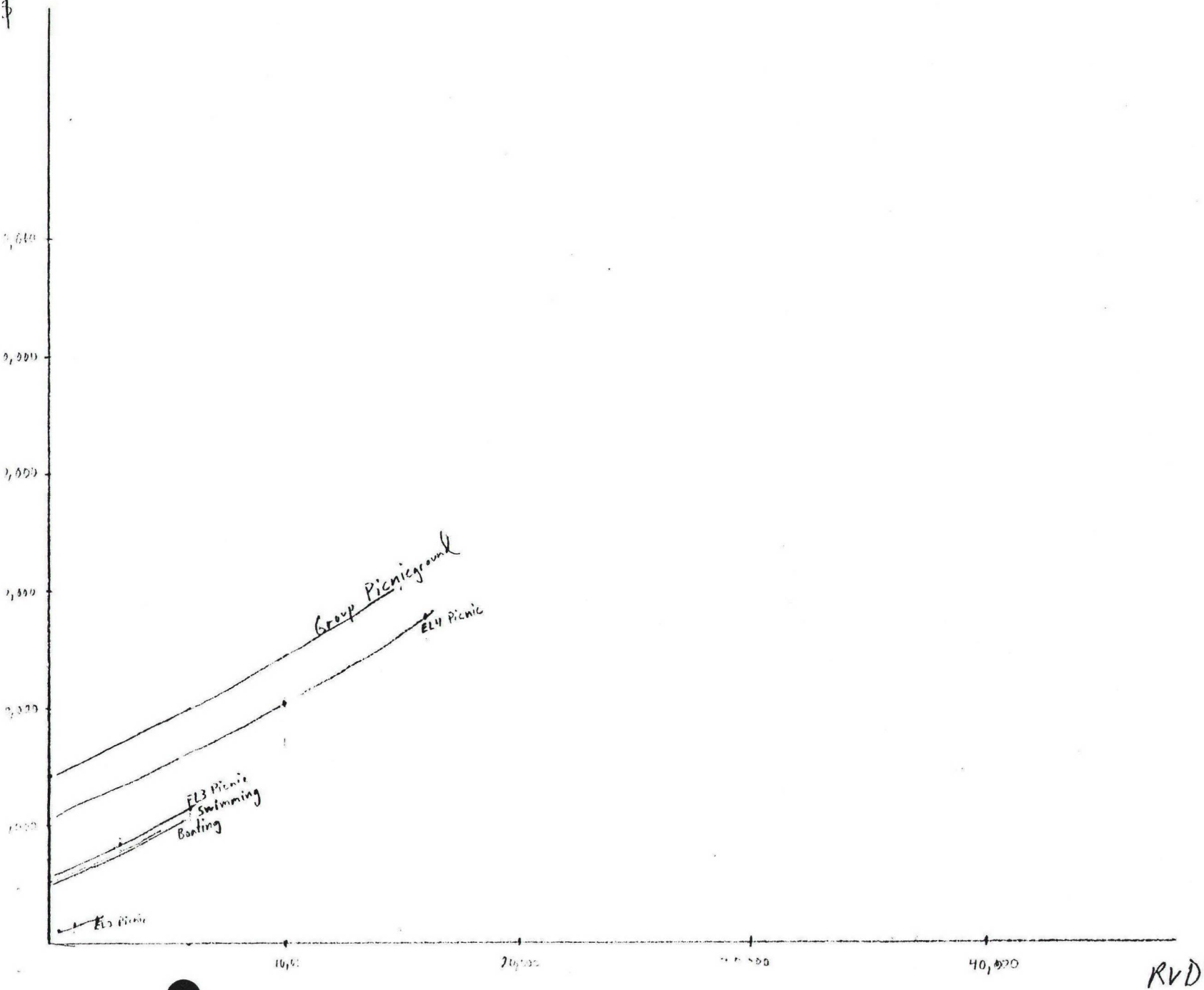
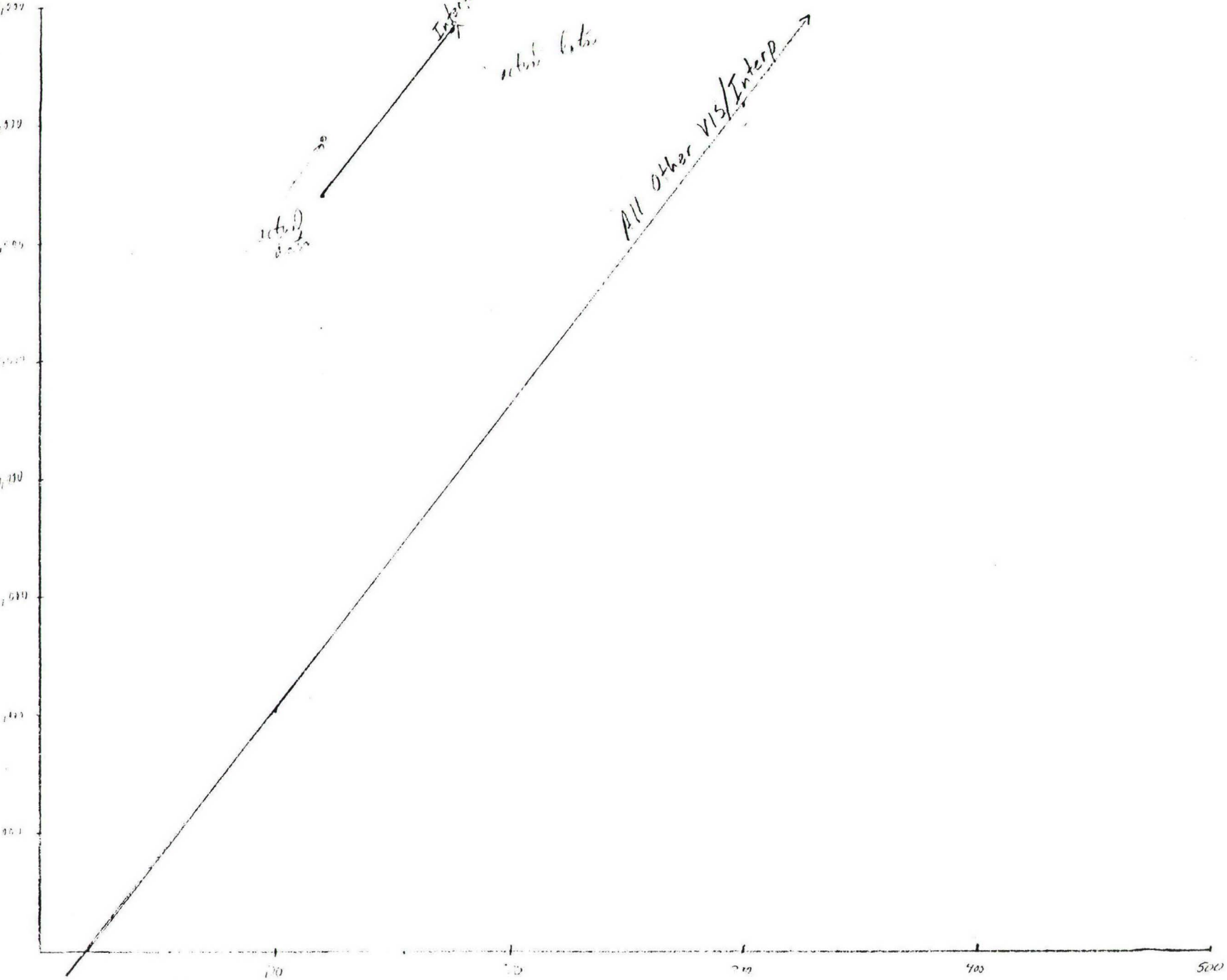


Figure 5.

Total Annual Cost as a Function of PAOT
for Interpretive Sites



PAC

Figure 6.

Total Annual Cost as a Function of RVD
for Interpretive Sites

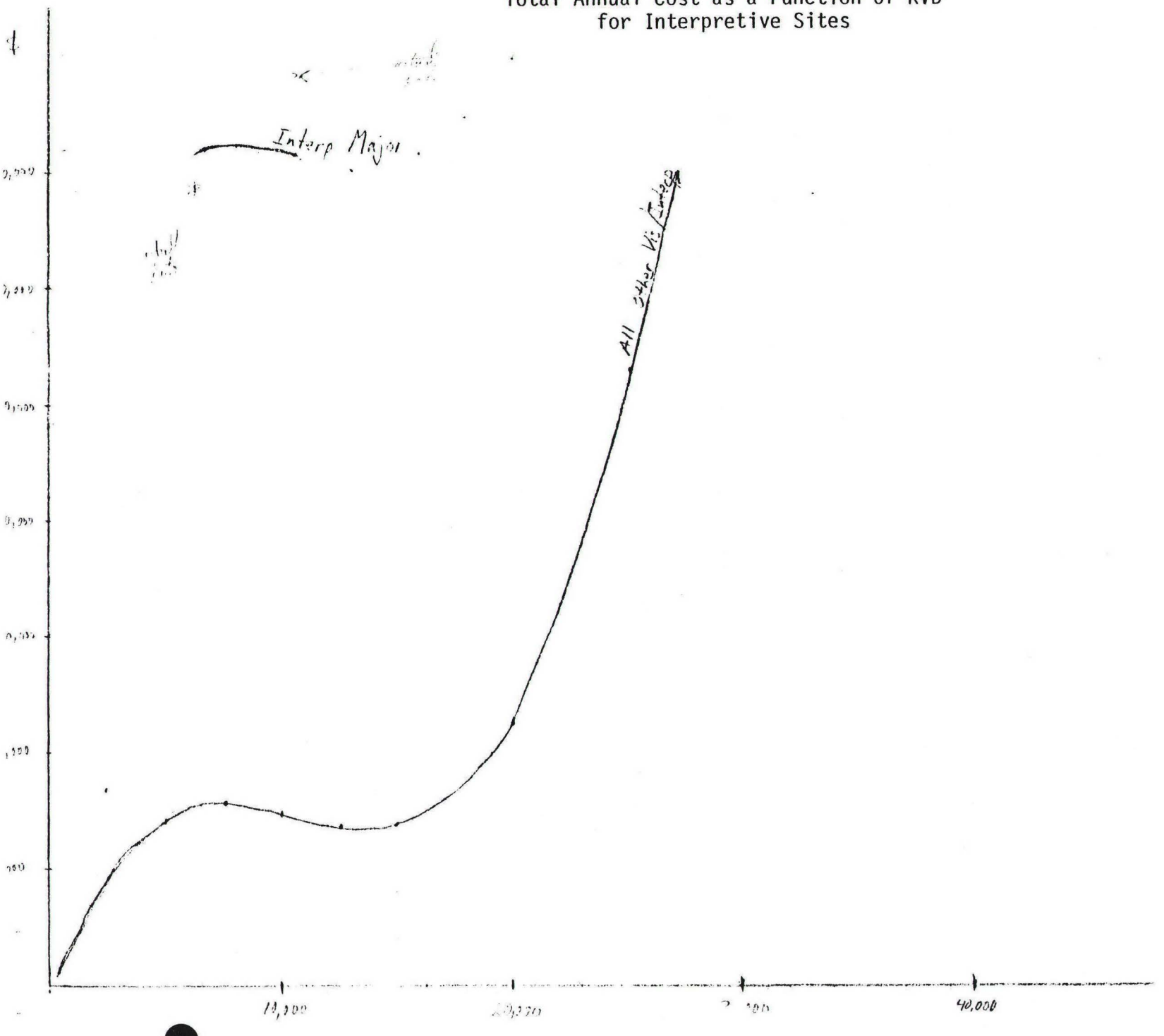


Figure 7.

Total Annual Cost as a Function of PAOT
for Family Campgrounds

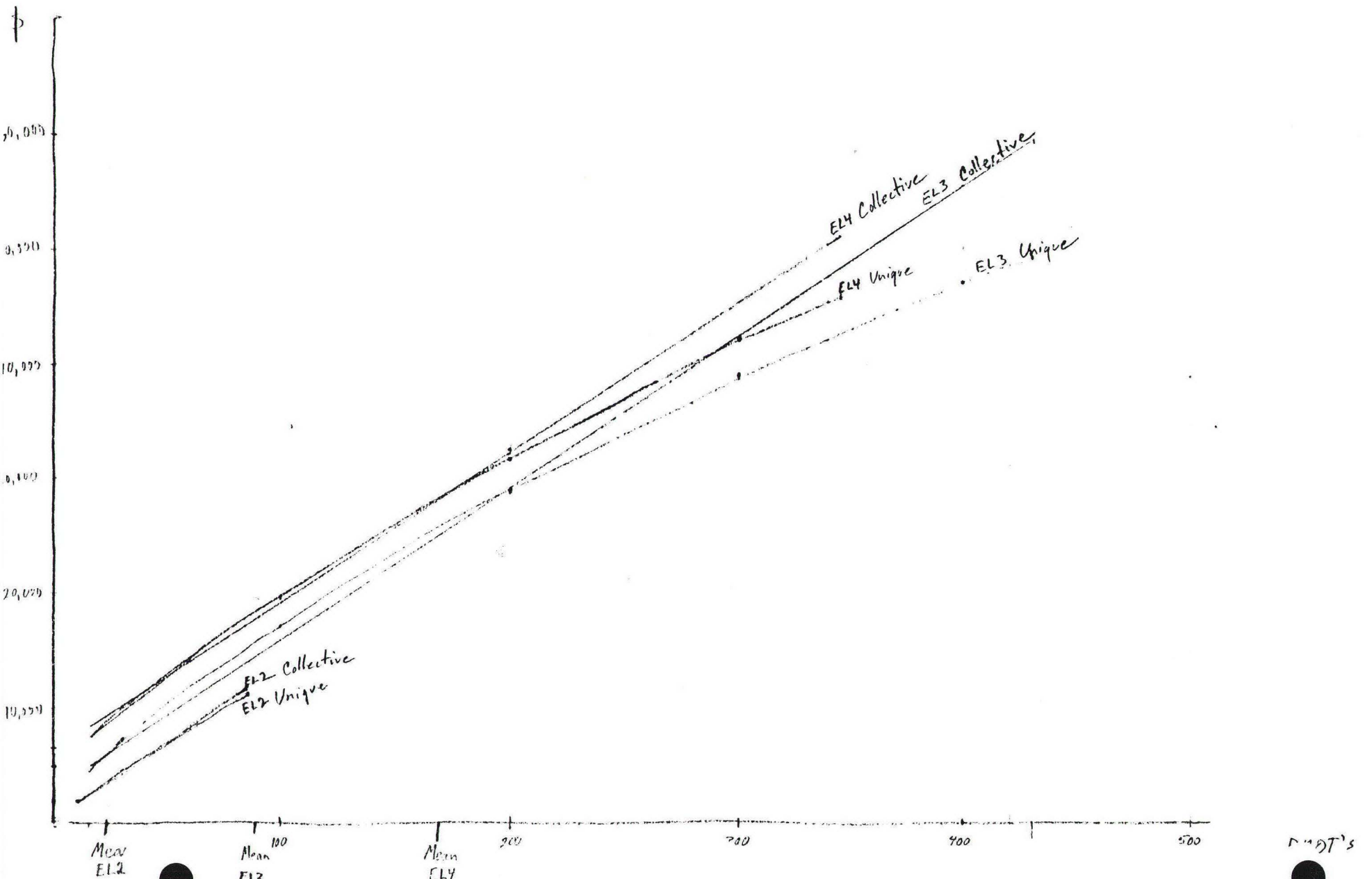


Figure 8.

Total Annual Cost as a Function of RVD
for Family Campgrounds

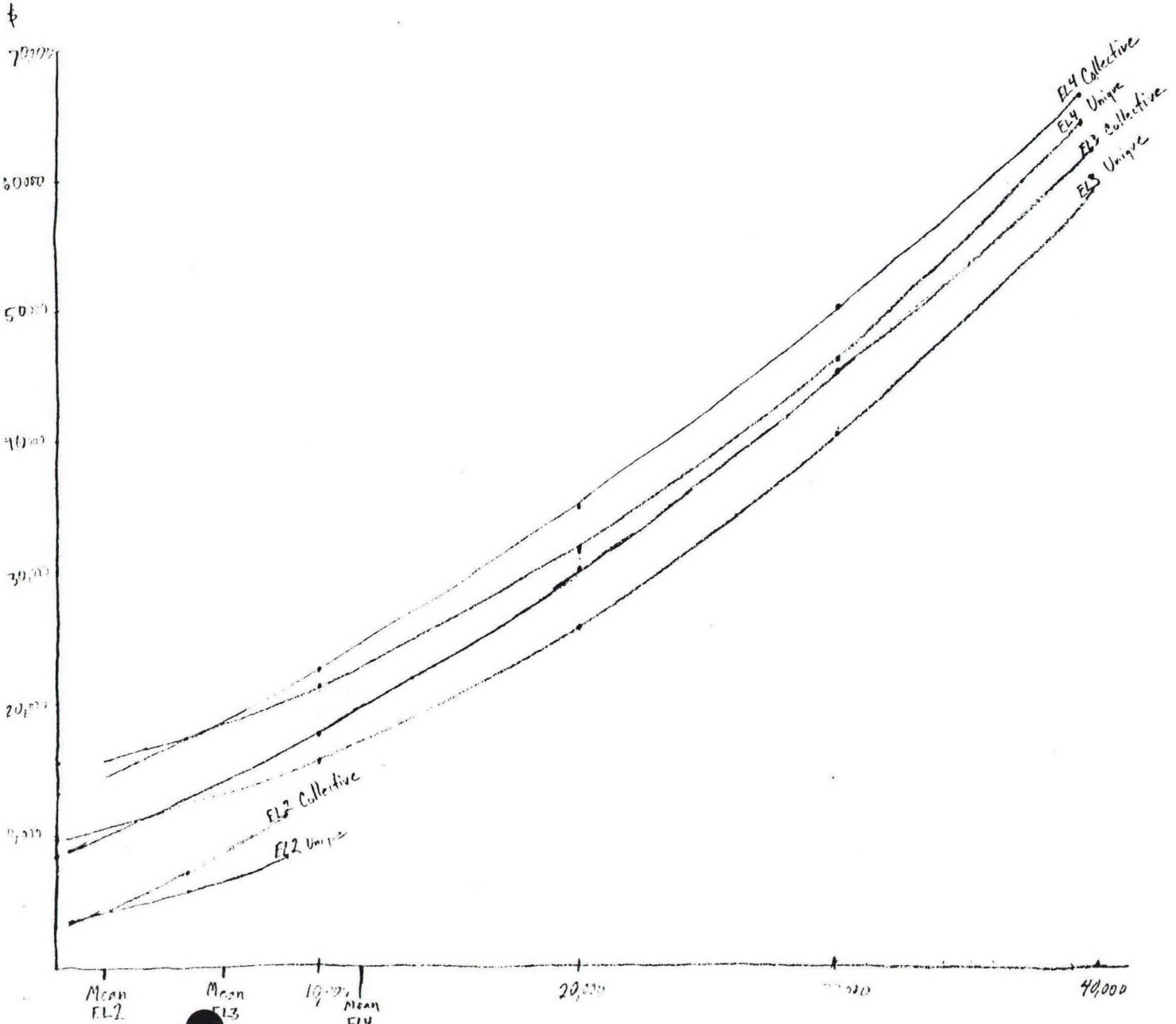


Table 12. Ranges of Data Collected for the Quantity Variables, PAOT and RVD, USFS Northern Region, 1980

	PAOT		RVD	
Site Type	Minimum	Maximum	Minimum	Maximum
EL_2 Family Campground	10	85	400	8,800
EL_3 Family Campground	15	430	400	39,800
EL_4 Family Campground	15	345	1,700	39,300
EL_2 Family Picnicground	15	25	400	2,200
EL_3 Family Picnicground	25	136	100	6,200
EL_4 Family Picnicground	30	160	200	16,200
Boating Sites	20	250	100	5,600
Swimming Sites	20	200	400	4,800
Group Picnicgrounds	32	490	200	14,800
Interpretive Major	120	175	6,200	10,500
All Other Interpretive	10	415	300	30,900

were everywhere increasing but had significantly lower R^2 statistics. In light of this, the cubic form was chosen to represent the data.

Because of the $TYPE_i$ dummy variable used, both the PAOT and RVD activity site Equations (15) and (16) provide estimates specific to family campgrounds. In addition, Equations (19) and (20) were uniquely designed to estimate family campground total costs as a function of PAOT and RVD respectively. Figure 7 graphically compares the PAOT total cost function for campgrounds derived from the collective activity site function to the PAOT total cost function estimated uniquely for family campgrounds. Both are separated into different experience levels. Because the collectively estimated equation is linear and the uniquely estimated equation is quadratic, they eventually diverge further and further. However, as stated above, the graphs should only be interpreted over the range of output of the collected data. The mean quantities of PAOT for each of the three experience levels have been marked on the horizontal axis. When comparing the collective and unique cost functions above these respective means they are actually quite similar. Figure 8 allows graphical comparison of the RVD collective and unique total cost functions for family campgrounds, broken down to the three different experience levels. Both curves are quadratic showing total cost to be increasing at an increasing rate. At low ranges of output they intersect, get farther apart, and then intersect again at high ranges of output. Again, the mean quantities of output have been marked on the horizontal axis for each experience level. Especially for EL_2 and EL_3 campgrounds, comparison above these means shows the collectively and uniquely estimated functions to be quite close.

Because the collective and unique campground equations give similar estimates of total cost for both the PAOT and RVD outputs, in most cases it will

not make much difference which one is used. However, since the unique equations were estimated only from campgrounds and contain a variable associated only with campgrounds, they are suggested. Also, for the RVD output, the percentage of variation explained is much higher in the unique equation than for the overall collective equation.

Once the above total cost functions have been estimated, average cost functions for each site categorization can be mathematically derived. To do this, each equation must be manipulated so that only the dependent variable (TC) and the quantity variable (PAOT or RVD) remain in the equation along with a constant term. This means replacing all other independent variables with their mean values and combining the resulting constant terms. At this point the function is simply divided by the output in question (either PAOT or RVD) resulting in an estimated average cost function. For example, the average cost (AC) function for boating sites when total cost (TC) is a function of RVD's is derived as follows:

$$TC = 3945.14 + .85(RVD) + .000013(RVD)^2 + 3038.03(G_2) \quad (21)$$

replacing G_2 with its mean value (.42) and combining terms gives,

$$TC = 5221.11 + .85(RVD) + .000013(RVD)^2 \quad (22)$$

dividing by RVD,

$$AC = \frac{5221.11}{RVD} + .85 + .000013(RVD) \quad (23)$$

where:

TC = total annual cost for boating sites, and

AC = average annual cost for boating sites.

This computation can be done for each of the total cost functions shown in Table 10. Average cost is simply total cost expressed on a per unit of output basis. For the linear total cost functions derived from Equations (15) and (17), the corresponding average cost functions will be decreasing over all ranges of output, as will the average cost curves corresponding to Equation (19), with a negative squared term. For the quadratic total cost functions with a positive squared term derived from Equations (16) and (20) and the cubic functions derived from Equation (18), the corresponding average cost functions will be decreasing over some range, hit a minimum, and then increase.

In addition to average cost functions, the estimated total cost functions can be used to derive marginal cost functions. Marginal cost is the first derivative of total cost with respect to the quantity variable (PAOT or RVD). Using boating sites as an example again, marginal cost when TC is a function of RVD's is found as follows:

$$TC = 5221.11 + .85(RVD) + .000013(RVD)^2 \qquad (24)$$

taking the first derivative with respect to RVD,

$$MC = .85 + .000026(RVD) \qquad (25)$$

Marginal cost functions can be computed for each of the total cost equations in Table 10. Marginal cost is the addition to total cost realized when output is increased by one extra unit. For quadratic total cost functions with positive squared terms, the estimated MC function will be a linear relationship with a positive slope. If a quadratic TC function has a negative squared terms, such as Equation (19), the resulting MC function will be linear with a negative slope. Linear TC functions will yield MC equations that are merely constants.

In other words, MC will be the same at all levels of output. The classical theoretical case is a cubic TC function such as Equation (18) where MC will be a quadratic function, decreasing and then increasing with increased levels of output.

As for the estimated total cost functions, the average and marginal cost functions derived from them represent their respective relationships only over the range of data observed. An estimated linear MC or AC function is most likely the result of sampled cases not being over a wide enough range of output to reflect both decreasing and increasing portions of these curves.

ANALYSIS OF RESULTS

Economic Efficiency

One application of cost functions is determining output levels of greatest economic efficiency. The point of maximum economic efficiency may be defined as the minimum of the average total cost function. By mathematical definition, this will also be the point where the MC and AC curves intersect each other.

It was shown that AC and MC curves can be derived for each site categorization from their estimated total cost functions. These average and marginal relationships can be used for an economic efficiency analysis of the sampled sites. Because of the different functional forms used in the statistical model, however, none of the AC curves derived for the PAOT output have minimums. The linear TC functions estimated for activity and passive sites, Equations (15) and (17), will result in AC curves which decrease at a decreasing rate over all ranges of output without ever reaching a minimum. Instead of a minimum, these curves will be asymptotic to a horizontal line determined by the slope coefficient of the TC functions. For example, if:

$$TC = a + bx,$$

then

$$AC = \frac{a}{x} + b.$$

In this case, when x (output) is increased to higher and higher levels, AC will become less and less but will never go below b. This relationship is shown graphically in Figure 9A. With this type of AC curve, there is no

Figure 9A.

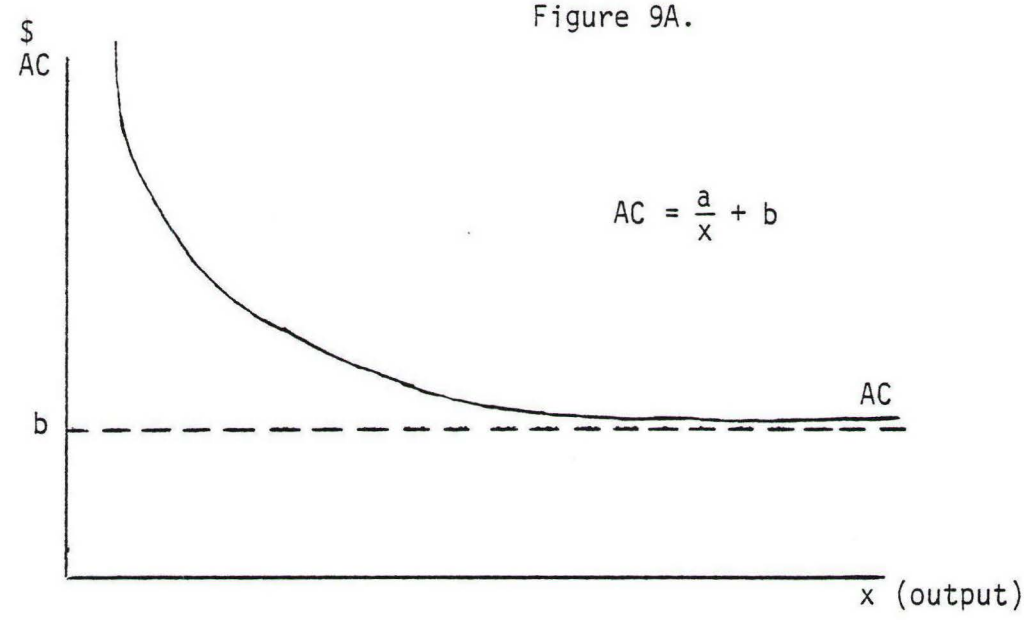
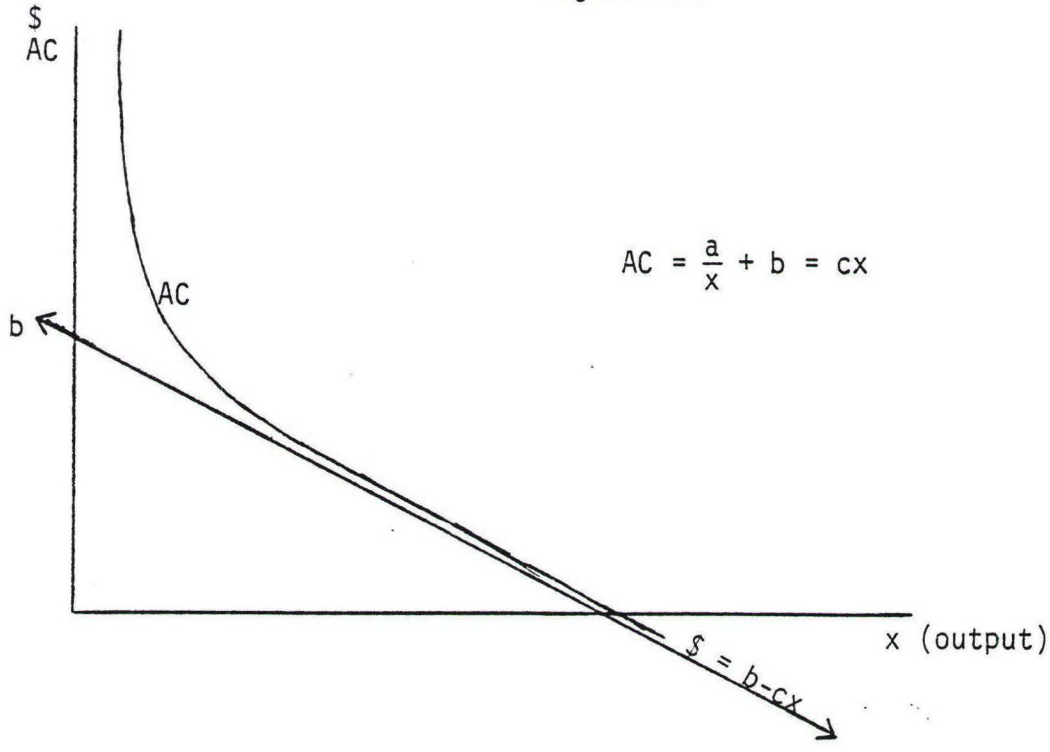


Figure 9B.



point of maximum economic efficiency. This is also the case for the quadratic TC function with a negative squared term estimated for family campgrounds (Equation (19)). The corresponding average curve will always be decreasing and will become asymptotic to a downward sloping line determined by the coefficients of the TC function. In the general case:

if

$$TC = a + bx - cx^2,$$

then

$$AC = \frac{a}{x} + b - cx.$$

For this case, as x is increased, AC will always decrease. The rate of decrease will start high, then decrease, but never become less than slope, -c. Both AC and TC will become negative. This AC curve is shown graphically in Figure 9B. Again, no point of maximum economic efficiency can be determined.

In both of the above two cases, the estimated cost curves suggest that the sampled developed recreation sites will become more efficient as output is increased, thus all sites are operating at a level below maximum economic efficiency. While it may be true that most sampled sites were below the most efficient level of PAOT capacity, it is a clear contradiction with theory to conclude that no point of maximum economic efficiency exists. As stated above, the estimated cost model should only be interpreted over the ranges of output represented by the sampled sites. Had data been available to represent larger ranges of output, the estimated cost curves would likely take on different shapes, which would allow points of maximum economic efficiency to be determined.

The quadratic and cubic total cost functions estimated for the RVD output <u>do</u> allow determination of an estimated point of maximum economic efficiency.

This is because the AC curves derived from a quadratic TC curve with a positive squared term or a cubic TC curve with a negative squared and positive cubed term, have both decreasing and increasing portions. In the general case, the point of maximum economic efficiency for a quadratic total cost curve is found as shown below:

if

$$TC = a + bx + cx^2,$$

then

$$AC = \frac{a}{x} + b + cx,$$

and

$$MC = b + 2cx,$$

maximum economic efficiency is where:

$$MC = AC$$

and so by substituted, the desired point is found:

$$b + 2cx = \frac{a}{x} + b + cx$$

multiplying both sides of the equation by x;

$$bx + 2cx^2 = a + bx + cx^2$$

combining terms;

$$cx^2 = a$$

dividing by c;

$$x^2 = \frac{a}{c}$$

and taking the square root;

$$x = \sqrt{\frac{a}{c}}$$

Thus, the point $\sqrt{a/c}$ represents the most efficient level of output. This calculation was done for all of the total cost expression derived from Equations (16) and (20). A similar manipulation of the AC and MC functions for the cubic TC expressions of Equation (18) gives another cubic polymonial which is cumbersome, but not impossible, to solve. The resulting points of economic efficiency for both the quadratic and cubic TC functions are shown in Table 13. Average and maximum levels of recorded use (RVD's) for each site category are included in the table for comparison. From Table 13, it can be seen that average use levels among sampled sites are in all cases well below estimated maximum economic efficiency. The column showing the highest sampled use level for each site category illustrates that at least one EL_3 campground, one EL_4 campground, and one interpretive type site operated at a use level above that of maximum economic efficiency. For most site categories, it is important to note that the estimated efficiency point is far beyond even the highest sampled output. This fact takes away from the reliability of the estimated points because, as stated above, the cost functions from which they are derived should only be considered reliable over the range of output represented by the collected data. However, the difference between the estimated efficiency points and the sample average use levels is large enough to place confidence in the conclusion that most sites are operating below maximum efficiency. This is not surprising when considering the low mid-week occupancy or use rates typical of developed recreation.

Table 13. Estimated Points of Economically Efficient Management for Selected Developed Recreation Sites, USFS, Northern Region, 1980.

Site Categorization	Estimated Output Level of Maximum Econ. Efficiency RVD's	Mean of Sampled 1980 Recorded Output RVD's	Maximum Sampled Output RVD's
EL_2 Family Campground	15,310	1,858	8,800
EL_3 Family Campground	25,114	6,358	39,800
EL_4 Family Campground	31,790	11,693	39,300
EL_2 Family Picnicground	7,372	1,100	2,200
EL_3 Family Picnicground	21,229	1,580	6,200
EL_4 Family Picnicground	28,819	4,550	16,200
Boating Site	20,049	1,846	5,600
Swimming Site	20,246	2,144	4,800
Group Picnicground	33,227	3,771	14,800
Interpretive Major	20,500	8,350	10,500
All Other Interpretive	16,200	6,070	30,900

Campground User Fee Revenue

A natural aspect of any cost analysis is to compare the estimated costs to corresponding revenues. In the case of Northern Region developed recreation, the only common source of revenue is user fees collected at overnight family campgrounds. As stated previously, not all of these sites have fee systems, even among those that are eligible. Of the sampled sites, there were no EL_2 fee campgrounds, 21 of 93 EL_3 campgrounds were fee sites, and 10 of 15 EL_4 campgrounds were fee sites. Fees charged were either $2.00 or $3.00 per party per night.

The total revenue from these fees falls short of costs. Table 14 shows averages of total revenue and both total and O&M cost on a per site and per RVD basis. Figures in the first and third columns are for all sampled EL_3 and EL_4 campgrounds respectively, while those in the second and fourth are for only the sampled campgrounds where fees were collected. The numbers in the last two rows show that the amount of costs paid by users is quite low. For EL_3 campgrounds, which are by far the most numerous type of site in the Northern Region, on the average site only 3.3 percent of the total costs and 11 percent of O&M costs incurred are covered by user fees. In other words, for every $100.00 of costs, there are only $3.30 of revenue. When considering just sites that charge fees, however, the percentage of costs covered by revenue at EL_3 campgrounds more than doubles to 7.9 and 26 percent respectively. It should be remembered that the total costs depicted in Table 14 include planning and facilities costs amortized at a 10 percent interest rate in addition to annual operation and maintenance costs.

One factor that the figures in Table 14 do not illustrate is the ratio, or percentage, of compliance by users in paying fees. Many interviewed recreation managers said they did not have the funds and manpower necessary to

Table 14. Revenue from User Fees Compared to Costs (Total and Operation and Maintenance), Family Campgrounds in USFS Northern Region, 1980, 10 percent.

	Campgrounds [a]			
	All EL_3	EL_3 Fee	All EL_4	EL_4 Fee
Average Annual Total Cost per Site	$14,459	$25,100	$29,464	$33,691
Average Annual O&M Costs per Site	4,307	7,636	6,860	7,747
Average Annual Revenue per Site	471	1,995	1,577	2,208
Average Total Cost per RVD	4.89	3.60	3.06	2.58
Average O&M Cost per RVD	1.39	1.19	.79	.68
Average Revenue per RVD	.04	.17	.12	.17
Revenue as a Percent of Total Cost per Site	3.3%	7.9%	5.4%	6.6%
Revenue as a Percent of O&M Cost per Site	10.9%	26.1%	23.0%	28.5%

[a] There were no EL_2 Fee Campgrounds.

adequately enforce fee compliance. In the absence of regular patrols by Forest Service personnel, user fee payment is enforced only by the "honor system." Greater public cooperation could increase the percentage of total costs covered by user fee revenues without actually raising the fees.

Real Costs of Construction

An investigation was made of possible changes in the real costs over time of providing Northern Region developed recreation. Real costs are simply costs adjusted for inflation by a price index. Use of a price index allows costs associated with different years to be measured and compared by dollars representing equal purchasing power.

It soon became apparent that availability of data would be the limiting factor in analyzing real costs. A thorough analysis requires data over a number of years. Because the Forest Service keeps no records of actual O&M costs for individual sites, an investigation of real operation and maintenance costs would be impossible. This is why the interview process was used for measuring 1980 O&M costs. The same is true for planning costs. Of the three major cost categories, past records for individual sites are kept only for facilities costs. These records and necessary supporting documents were not only difficult to locate but verification was also difficult because the appropriate personnel were often not accessible. Consequently, time and financial resources allowed real cost data to be collected only for sampled sites in the Lolo National Forest.

Other than the current replacement or construction cost, there are three pieces of information necessary to analyze possible changes in real costs of construction. The first is the total cost incurred for <u>original</u> construction.

In most cases this datum was recorded on the PMIS Real Property Record for individual sites at the Supervisor's Office. It was shown as a lump figure under the title "Acquisition Cost." Although this figure does not provide a breakdown as to how funds were spent or how the project was financed, Real Property statements are assumed to reflect the value of contributed manpower programs such as Job Corps, YCC, CETA, etc.

The original construction cost is not meaningful unless it is associated with the year, or years, construction took place. This second piece of datum is to be on the Real Property Record under the title, "Acquisition Date" but is often not entered. Sometimes Block D of the RIM Basic Address Record had the year of development entered but, again, often it was missing. A third method for collecting this datum was to contact the recreation specialist at the appropriate Ranger District asking him or her to check other records and documents. Through a combination of these three sources, the year of original construction was determined for a sample of sites on the Lolo National Forest.

The third piece of information necessary for analyzing real construction costs is a measure of physical capacity at or near the time of construction. This is important because some sites have been significantly expanded or reduced over the years. It would not make sense to compare an original construction cost with a current replacement value computed for a site with half again as many facilities. Comparing costs on a per PAOT basis alleviates this problem. PAOT capacity is the best unit for this purpose because it takes into account both the size of the site and the number of facilities placed on it. Unfortunately, Real Property Records do not contain this datum, nor is it available on RIM Records. A search through old files at the Supervisor's Office, however, produced two documents that show PAOT capacity in past years.

These are Inventory Records (Form 2300-6) dated 1965, and Field Inventory Reports (Form 2300-16) with dates varying from 1959 to 1965. These documents are fore-runners of the RIM system. In most cases for which an original construction cost was available, they provided a PAOT measure near the time of construction.

With the year of development as a point of reference, original construction cost was adjusted for inflation by conversion into 1980 dollars. This step was facilitated by the US Department of Commerce Composite Construction Cost Index. This index is similar to the Consumer Price Index (CPI) but relates specifically to prices of construction goods. It is actually a combination of various construction indices.

Both the current replacement cost and adjusted original construction cost were divided by their respective PAOT capacity for each of the 17 cases. Computing the means for these two values across all measured cases allows a more general comparison. The adjusted original cost mean per PAOT is $1,385.88, while the current cost mean is $1,118.24. If anything, the smaller current figure would suggest a decrease in real costs.

For a test to see if the difference between the two means is significant, a two tailed t-statistic was calculated using the following formula:

$$t = \frac{\bar{d} - D_0}{\sqrt{\frac{s_d^2}{n}}} \qquad (26)$$

$$s_d^2 = s_1^2 + s_2^2 - 2rs_1s_2$$

where:

$\bar{d}$ = difference of the means between the two populations,

D_0 = hypothesized difference between the means (zero in this case),

s_d^2 = estimated variance of the difference,

n = sample size,

s_i^2 = ith sample population variance,

$s_1 s_2$ = sample population covariance, and

r = sample correlation coefficient.

A t-value of -.84 was computed using the above formula. This low value does not allow rejection of the hypothesis that the true means are equal at any reasonable level of significance. Therefore, the data collected suggest that real costs of constructing USFS developed recreation sites in the Northern Region have not changed. A larger sample would have to be used in order to make a more definite conclusion on this issue.

Contributed and Borrowed Labor

During the interview process, it was attempted to measure all labor associated with operating and maintaining the various developed recreation sites. Typically, this meant accounting for three categories of personnel. First, there were permanent and temporary Forest Service employees with developed recreation being at least part of their regular job responsibilities. Work in developed recreation supplied by this group is, for the most part, planned, budgeted, and accounted for. Another category of personnel was composed of Forest Service employees that were not hired to work with developed recreation and did not have developed recreation as a regular job responsibility. These were mainly seasonal employees such as fire suppression crews whose regular responsibilities did not require immediate attention or who could quickly complete a short job at a developed recreation site enroute to, or from, their regular job activity. This type of "borrowed" labor is not planned

or budgeted for and typically will not show up in accounting records as charged to developed recreation. The third category of labor was that supplied by "contributed" manpower programs such as YCC, YACC, CETA, and Job Corps. With the exception of Forest Service personnel who coordinate and supervise, these programs are funded outside the Forest Service and consequently the associated labor does not show up in regular Forest Service budgets and accounting records. Also included in this category was any volunteer labor provided by private individuals or organizations. Ranger District recreation managers were usually aware of the wage received by participants in contributed manpower programs by their sponsoring agency. For volunteer labor, the manager's opinion of the wage that would have been earned, had the person been a regular FS employee, was applied to the estimated man-hours as the associated cost.

In recording data, borrowed and contributed labor were kept separate from regular budgeted labor so a comparison of the relative magnitude could be made. Table 15 gives the averages of these two classifications for each site type. The column furthest to the right shows that non-budgeted labor was estimated to range from 10.5 to 39.5 percent of budgeted labor among the different kinds of sites. This range translates to an average 27.7 percent for all sampled developed recreation.

The 27.7 percent above can be interpreted as saying that more than one-fourth developed recreation labor costs are not budgeted or accounted for by the Forest Service. Because the system is not designed to account for all these costs, this figure, in itself, is not alarming. However, many recreation managers interviewed were concerned that the large contribution of non-budgeted labor was not being taken into consideration in broad Federal fiscal planning. The fear was not being able to maintain facilities and offer the

Table 15. Comparison of Contributed and Budgeted Labor, USFS Northern Region, 1980.[a/]

Site Classification	Average Budgeted Labor Costs	Avg. Contributed and Borrowed Labor Costs	Contributed and Borrowed as a % of Total Labor Costs
Family Campgrounds	1,657.53	657.27	28.4
Family Picnicgrounds	861.38	309.07	26.4
Boating Sites	615.00	197.96	24.4
Swimming Sites	609.22	237.67	28.1
Group Campgrounds	1,313.67	497.67	27.5
Group Picnicgrounds	1,706.71	879.14	34.0
Interpretive Major	14,704.00	1,720.00	10.5
Interpretive Minor	458.00	299.43	39.5
Observation Sites	383.17	95.17	19.9
Documentary Sites	350.67	157.00	30.9
All Site Types			27.7

[a/] All figures on a per site basis.

same service levels if large Federal budget cuts eliminate or massively reduce contributed manpower programs. Our conclusion is that contributed labor is a significant part of the O&M costs and should not be ignored.

Comparison of Methods to Estimate Operation and Maintenance Costs

For a check on consistency, it was decided to compare operation and maintenance costs recorded by the Forest Service's PAMARS accounting system with those of the Ranger District recreation manager interview process. This analysis was done on a per Ranger District rather than per recreation site basis because this is the only way the PAMARS system accounts for costs. The per District basis is suitable for a general comparison but not for deriving costs on an individual basis. In most cases, only a portion of the sites on any one District were sampled, so that adding up the interview estimated costs of individual sites within a District would not provide a figure comparable to PAMARS. However, when there were many sites on a District or when sampled sites made up a high percentage of the total, costs were often estimated for the whole District during the interview. For these cases a comparison with PAMARS could be made only if the District in question used one or more Management Codes and corresponding Project Manager Statements specifically for developed recreation operation and maintenance costs. With these limitations, only 15 of the 30 sampled Ranger Districts could be used for comparison. Had formal analysis of PAMARS vs. interview estimated O&M costs been planned prior to data collection, most of the 30 Districts could have been utilized.

The Project Manager Statements obtained were for Full and Reduced Service Management (FSM and RSM) of developed recreation sites as defined by codes

A11 and A13 in the Management Information Handbook (1309.11). The interview derived values must be adjusted to reflect only those costs that are to be accounted for on these statements. Consequently, wages for contributed labor such as YCC and CETA, contracts usually accounted for at the Supervisor's Office, and salaries charged to Program Management were subtracted. Salaries earned by permanent personnel at higher GS grades such as Resource Assistants or Supervisory Foresters are usually charged to Program Management.

Once the interview estimated costs were adjusted they could be compared to the corresponding Project Manager Statements. The PAMARS figure best used for comparison is the sum of the paid and unpaid entries at the end of fiscal year 1980. The unpaid entry represents funds for which there is a firm obligation for expenditure such as a formal contract. Thus, for most purposes these dollars should be considered as a cost encumbered.

The adjusted interview and PAMARS cost figures for the 15 Ranger Districts are displayed on Table 16 for comparison. PAMARS planned costs and the paid only dollars are also entered on the table in separate columns for additional perspective. The means across all 15 cases are computed to facilitate general comparison. Quick observation shows the interview average to be about $2,300 less than the PAMARS paid plus unpaid figures.

For a test to see if the difference between the PAMARS paid plus unpaid figures and the interview derived figures are significantly different, a t-statistic was calculated using a two tailed test. A t-value of 1.088 was computed using Equation (26). Thus, the data tend to suggest that the PAMARS accounting system reports a value for comparable components of operation and maintenance costs similar to the estimates made through personal interviews with District recreation specialists.

Table 16. Comparison of PAMARS Accounting vs. Estimated O&M Costs, by Ranger District, USFS Northern Region, 1980.

Ranger District	PAMARS			Adjusted Interview Estimation
	Planned	Paid	Paid & Unpaid	
Beartooth	56,000	45,540	65,889	49,573
Dillon	19,621	17,527	19,069	18,268
Big Timber	16,200	14,558	16,903	17,585
Bozeman-Gall	40,814	40,813	46,900	36,390
West Fork	20,795	14,044	21,215	15,050
Jefferson	23,140	21,129	23,007	20,861
Philipsburg	21,305	23,313	24,730	36,471
Hungry Horse	5,740	23,058	30,069	30,195
Swan Lake	14,990	23,139	24,239	22,965
Fortine	9,600	9,389	9,504	6,482
Seeley Lake	30,536	29,042	36,276	32,302
Red Ives	10,704	7,471	9,473	9,276
Sandpoint	38,133	34,916	40,623	36,715
St. Maries	13,490	14,788	14,882	20,361
Selway	12,928	14,707	16,814	12,023
Mean	22,266	22,229	26,640	24,301

The mean of the PAMARS paid values is about $2,000 less than the interview figures. One explanation for this difference is the item entitled "other" on the Project Manager Statements. When discussing this item with Ranger District personnel there was usually no record or recall of how, when, or why funds were spent. Since an attempt was made to measure specific categories of operation and maintenance costs, the item "other" tends not to be reflected by the interview process. The mean for "other" across the 15 Districts used for comparison is $2,526. This value is large enough to account for the difference between the PAMARS and interview means.

A final note in comparing the PAMARS and interview figures is that without adjusting for contributed manpower, Supervisor's Office contracts, and Program Management, the interview estimates are higher than the PAMARS reported costs. In other words, the operation and maintenance costs reported earlier are higher than what would have been used if the PAMARS system was the sole source of O&M data. Of course, PAMARS only gives District average figures and could not have been used for analysis by sites.

SUMMARY AND CONCLUSIONS

This study has described the existing treatment opportunities for developed recreation in the Northern Region and analyzed in detail the costs of managing them. Costs associated with the provision of developed recreation have been approached in two basic ways, first, as average values, and second, as cost functions.

Average costs, shown in the tables above, give a description of the dollar magnitudes of costs of developed recreation in Region One faced by the Forest Service. The breakdown given is extremely useful when deciding which types of sites or experience levels are more expensive than others and, on the average, by how much. This should be helpful for managers in budgeting and planning.

Since the estimated cost functions described are statistically significant, it can be concluded that they are a useable indicator of the 1980 cost structure for Northern Region developed recreation. In other words, the estimated total cost functions help describe what factors affect or change cost and by how much. As opposed to the static analysis of the average figures, these functions allow analysis of changing situations. One obvious management application for this would be predicting costs for proposed sites or additions to existing sites. Caution must be used when predicting costs for proposed sites or additions to existing sites. Caution must be used when predicting costs for a particular site, however, because the functions were estimated from a sample and only represent the average site within each category. Other examples of changing situations which the cost functions could be used to analyze would be approximating the change in costs when use is expected to

increase, the change in cost when a site is to be modified to a different experience level, and the change in cost caused by altering the length of the managed season.

As shown, the average cost curve can be used to draw inferences about the economic efficiency of the output levels of the sampled sites. A general conclusion was that most sites were operating at levels below that of maximum economic efficiency for both the PAOT and RVD outputs. It is important to realize, however, that this alone does not mean that all managers should do everything possible to increase the number of PAOT's they provide and the amount of use at their sites. In so doing they may lower their average cost (cost per unit of output) but their total cost will surely rise. When faced with small or decreasing budgets, total cost will usually be more important than average cost. Another restriction on the application of the economic efficiency analysis is that managers have little control over use levels. Therefore, the only application of the economic efficiency analysis is making comparisons among different sites to determine which are operating more efficiently than others.

A brief comparison of total costs to total revenue from user fees for overnight campgrounds was also made. From this comparison it is apparent that fees paid by users offset only a small portion of the costs of providing the camping opportunity. For other site types and EL_2 campgrounds no significant revenue is collected from users (with the possible exception of reservation fees for some group camp- and picnicgrounds). The question of whether use of developed recreation sites should be subsidized and, if so, by how much is beyond the scope of this study. It can be said, however, that in 1980, when all sites and site types are considered, public use of Northern

Region developed recreation facilities was subsidized by the Federal Government. If targets for the amount of subsidization are established, whether they be zero, 100 percent, or anything inbetween, the results herein can be used to help make decisions on the amount of fees and whether minimum criteria for eligible fee sites should be lowered or raised. If the amount of revenue that would be received with complete compliance in fee payment was calculated, the figures presented could also be used to help determine the magnitude of the fee compliance problem region-wide.

The comparison of budgeted and non-budgeted labor should be applied mainly at the regional or nationwide level in planning and budgeting. Individual recreation managers at Ranger Districts and Supervisor's Offices already know how much of their developed recreation labor needs are filled by volunteers, contributed manpower programs, and borrowed crews. The important thing is for those engaged in the broad allocation of financial resources to realize the magnitude of non-budgeted labor and the probable consequences of decisions that would make these sources of labor unavailable.

The measurement of non-budgeted labor is also important when attempting to estimate the true cost of providing developed recreation. In allocation decisions for all types of public resources (financial, natural, and other) the true economic costs and benefits associated with different alternatives should be at least one criterion. As stated at the beginning of this report, the Resources Planning Act (1974) and the National Forest Management Act (1976) both call for an identification of costs and benefits in management decisions. While user benefit measurement was not within the objectives of this project, the estimated costs can be inserted into the respective half of a benefit-cost analysis. Through techniques such as the personal interview process,

where the contribution of non-budgeted labor was measured and by combining the major cost categories (planning, facilities, and operation and maintenance) this study provides estimates of total cost which are more accurate and complete than any available through regular Forest Service accounting records (including PAMARS). When applying the estimated costs to a benefit-cost analysis, the total cost functions for the RVD output should be used because recreation benefits are typically expressed in recreation visitor-days.

Study Limitations

One limitation of this study, which has already been mentioned, is that the estimated cost functions are only reliable over the range of output represented by the sample data. In other words, these functions are really estimates of the total cost relationship between certain output levels and do not provide a description of the true total cost function in its entirety. Consequently, the estimated equations are mostly of linear and quadratic functional form rather than the cubic shape suggested by theory. This limitation means that extrapolations to very high or very low levels of output should not be made. For example, the intercept, or value of the dependent variable when the independent variable is zero, is expected to be zero for long run total cost functions. The intercepts given by the estimated functions, however, range from negative values to very high positive values.

Another limitation for this and all similar studies is the accuracy of the raw data. Data collection efforts of this project were based on past studies and were carefully planned. The process extended over several months and required considerable expense. Even with the best preparation, though, collecting the necessary information was cumbersome because, as stated above,

the Forest Service simply does not keep the kind of records desired for a total cost study which considers individual recreation sites. Of greatest concern is the measurement of use levels. There are various techniques for estimating use at individual sites and several different mechanical devices that can add accuracy. The problem is that all these techniques require a lot of time and money, which many recreation managers do not have. Another problem is that the format used for recording use levels automatically tends to overestimate total use at individual sites. Separate use estimates are given for each of the different activities associated with a site. Activities for a given site might include overnight camping, picnicking, fishing, boating, swimming, and hiking or walking. The aggregate use level, the sum of all the separate activity use levels, was used for this study because the total use of facilities is most relevant when analyzing costs. The type of over estimation described here would affect results by biasing downward the cost per RVD figures. The corresponding estimated cost functions would shift down somewhat but the shape would not change. Per site costs and costs related to the PAOT output would not be affected.

A third limitation of this study stems from costs that were not measured and included in the total cost estimates. Basically, this study considered all costs that could be directly tied to the management and provision of individual developed recreation sites. There are some less obvious and more indirect costs that could not feasibly be measured. These costs, for the most part, can be labeled administrative costs. Within the administrative cost category there would be a number of different subcategories of cost just as there are a number of different types of cost within the operation and maintenance cost category. For example, part of the salaries of administrators,

planners, various specialists, and their supporting staffs at the Supervisor's Offices, Regional Office, and Washington D.C. Office should be considered a cost if they had anything to do with developed recreation. In addition, the paper, typewriters, general office supplies, electricity, phone service, vehicles, and even building space used by these people when working in connection with developed recreation should be valued and considered as part of the true cost of public developed recreation. The problem with including these types of costs in a study such as this is the almost impossible task of determining what portion of salaries, materials, and buildings, etc., to attribute to developed recreation in general, let alone individual sites. The task becomes more difficult the farther it gets from the Ranger District recreation manager and staff. Theoretically, administrative costs for developed recreation could be traced all the way to the Secretary of Agriculture and even the President of the United States, the chief of the executive branch. Obviously, a line must be drawn somewhere. For this study, it was decided that instead of trying to estimate some vague portion of the administrative cost category, only costs that could be directly tied to the management and ownership of individual sites would be considered. This is justified because the objectives given for the project deal mainly with improving management of developed recreation sites, and not with the administration of developed recreation in general. Not including administrative costs is a limitation only for applications requiring an investigation of all cost categories, such as broad resource allocation decisions. For these cases it is important to realize the existence of administrative costs and make appropriate adjustments.

Recommendations for Further Research

As discussed above, it was difficult and cumbersome to collect accurate cost data for the project because records of actual operation and maintenance costs for individual sites did not exist. One solution to this problem would be to actually generate a set of cost records during a fiscal year for a small predetermined sample of sites. This would require cooperation and some extra time on the part of the recreation managers involved, but many would probably consider the information they were collecting to be directly beneficial to their program. The manager, or person in charge of the task for a given Ranger District, would need to keep records on a daily basis during the recreation season as to the man-hours, vehicle miles, and materials associated with the operation and maintenance of sites to be included in the study. This task would not be difficult if the crews actually doing the work kept track of the number of trips they made to particular sites, which vehicles were used, how long they spent at the site, and what materials they used. The researcher should have tabulation sheets printed for distribution to crew leaders to facilitate this process. In most cases, written records for utilities and contracts are made automatically. Copies of the corresponding bills and agreements would simply have to be made accessible at the end of the year. If a contract or utility bill was for more than one site, the manager would have to be able to estimate the percentage that should be applied to each of the particular sites involved. At the end of the year, the researcher would go to each sampled Ranger District to collect the records and tabulations, briefly discuss them with the manager, and find out any missing pieces of information, such as the appropriate pay scales to apply to the tabulated man-hours or physical characteristics of different sites. With good coopera-

tion from Ranger District personnel, this record generating process should produce highly accurate raw data. One way to increase cooperation would be for the researcher to write or meet with the recreation managers as a group, before the process began, to explain applications of the information to be collected.

A second suggestion for further research in developed recreation costs is to consider the PAOT and RVD units simultaneously when estimating total cost functions. In this study, these two outputs were always considered separately. This is because, as explained, there are separate production processes for PAOT's of recreation opportunity and RVD's of recreation experience. Another reason for not using them together in estimated equations was concern over the multicollinearity problems that would arise due to the high degree of correlation between the number of PAOT's of capacity at a site and the amount of use received. Multicollinearity would make coefficients estimated for the PAOT and RVD variables far less reliable. It might be helpful, however, to estimate total cost as a function of RVD's when PAOT capacity is held constant or within some range. This would result in more of a short run cost curve because physical plant capacity would be fixed. In other words, the PAOT units would be considered strictly as a measure of output capacity and not as an output. There are three possible methods of accounting for both PAOT and RVD simultaneously when estimating total cost functions. The first would simply be to include both PAOT and RVD as continuous independent variables in the same equation and accept the resulting multicollinearity. To graph the relationship, the PAOT variable would be replaced by its mean value. The resulting equation would represent total cost as a function of RVD for the average site capacity. Another method would be to develop a set

of dummy variables to further subcategorize the sites, analagous to the experience level (EL) variables. Sites of larger capacity should have greater fixed costs and different variable cost relationships resulting in cost functions with different slopes and intercepts. Dummy variables and corresponding interaction terms could account for this phenomenon. The third method, which could also account for differences in both fixed and variable costs among site capacities, is estimating entirely separate equations for each class or range of PAOT capacity. The problem of multicollinearity should be minimal with the second method and nonexistent with the third. To get reliable and statistically significant results with these two methods, however, there must be an adequate number of observations within each capacity category, especially for the third method. This could only be insured by stratifying the sample to consciously select sites of different capacities, a method not utilized in this study.

APPENDICES

APPENDIX A

Appendix Table 4. Standard Deviations Corresponding to Average Annual Costs of Family Campgrounds in the Northern Region (Table 4), 1980 (10%)

	Family Campgrounds			
PER TREATMENT OPPORTUNITY (SITE)	EL_2	EL_3	EL_4	All
Annual Planning	34.79	134.48	144.15	146.20
Annual Replacement Value of Facilities	1,986.54	9,351.24	14,619.57	10,381.84
Annual Operation and Maintenance	695.89	3,534.44	3,095.52	3,377.45
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	344.03	979.99	1,244.75	933.66
- USFS budgeted.....	340.73	1,822.58	1,198.81	1,638.61
2. Contract.....	286.56	678.68	1,005.00	715.67
3. Vehicle.....	118.26	705.13	322.30	589.68
4. Utility.....	0.00	77.34	150.73	82.70
5. Tools and Materials.....	133.69	331.36	268.99	312.16
Total	2,337.99	12,366.65	17,452.33	13,231.13
PER TREATMENT UNIT (PAOT)				
Planning	0.59	0.67	0.42	0.64
Replacement Value of Facilities	65.57	102.98	77.96	92.23
Operation and Maintenance	47.63	35.82	14.97	38.82
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	23.86	9.69	7.76	14.83
- USFS budgeted.....	25.06	24.37	8.40	23.63
2. Contract.....	13.17	7.99	3.74	9.41
3. Vehicle.....	7.27	4.87	2.40	5.75
4. Utility.....	0.00	.58	.65	.52
5. Tools and Materials.....	7.69	3.66	1.96	5.03
Total	94.35	119.65	88.99	110.03
PER TREATMENT OUTPUT (RVD)				
Planning	0.05	0.10	0.05	0.08
Replacement Value of Facilities	1.89	4.61	4.18	4.05
Operation and Maintenance	.77	1.46	.64	1.25
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	.28	.34	.28	.32
- USFS budgeted.....	.41	.86	.23	.73
2. Contract.....	.18	.24	.09	.21
3. Vehicle.....	.15	.18	.07	.17
4. Utility.....	0.00	.21	.27	.19
5. Tools and Materials.....	.08	.09	.07	.09
Total	2.40	5.78	2.36	4.88

Appendix Table 5. Standard Deviations Corresponding to Average Annual Costs of Family Picnicgrounds in the Northern Region (Table 5), 1980 (10%)

	Family Picnicgrounds			
PER TREATMENT OPPORTUNITY (SITE)	EL_2	EL_3	EL_4	All
Annual Planning	5.31	44.37	102.66	64.02
Annual Replacement Value of Facilities	3,701.01	3,197.54	5,006.30	3,847.70
Annual Operation and Maintenance	463.82	1,676.55	1,516.36	1,572.53
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	169.09	454.60	534.52	429.64
- USFS budgeted.....	282.15	629.05	1,086.58	685.82
2. Contract.....	95.32	649.75	361.26	565.00
3. Vehicle.....	87.35	263.61	204.77	234.21
4. Utility.....	0.00	22.23	153.21	60.07
5. Tools and Materials.....	94.50	151.09	54.25	139.43
Total	3,642.28	3,752.17	6,268.67	4,594.61
PER TREATMENT UNIT (PAOT)				
Planning	.19	.94	.29	.83
Replacement Value of Facilities	185.98	64.48	31.21	96.80
Operation and Maintenance	19.81	37.58	12.73	32.41
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	8.09	7.53	10.61	8.06
- USFS budgeted.....	13.47	17.66	6.60	15.81
2. Contract.....	5.58	14.67	3.09	12.49
3. Vehicle.....	3.92	4.72	1.62	4.41
4. Utility.....	0.00	.47	1.23	.59
5. Tools and Materials.....	3.69	3.53	2.28	3.40
Total	183.32	79.40	32.92	103.65
PER TREATMENT OUTPUT (RVD)				
Planning	.02	.32	.52	.32
Replacement Value of Facilities	3.78	28.96	23.29	25.00
Operation and Maintenance	.73	2.09	7.69	3.21
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	.27	.42	2.93	1.11
- USFS budgeted.....	.25	.50	2.05	.83
2. Contract.....	.18	1.14	1.55	1.08
3. Vehicle.....	.13	.35	.88	.42
4. Utility.....	0.00	.01	.01	.01
5. Tools and Materials.....	.16	.22	.29	.22
Total	3.87	29.96	31.49	26.82

Appendix Table 6. Standard Deviations Corresponding to Average Annual Costs of Various Activity Sites in the Northern Region (Table 6), 1980 (10%)

	Boating Sites	Swimming Sites	Group Campgrd.	Group Picnicgrd.
PER TREATMENT OPPORTUNITY (SITE)				
Annual Planning	62.41	61.63	57.26	163.20
Annual Replacement Value of Facilities	9,229.54	5,674.92	2,129.83	17,275.29
Annual Operation and Maintenance	1,800.71	1,265.64	1,247.09	6,162.52
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	383.14	473.35	151.76	1,399.74
- USFS budgeted.....	812.65	508.04	640.43	2,262.07
2. Contract.....	288.98	376.82	349.28	1,003.21
3. Vehicle.....	156.43	161.43	68.23	1,275.98
4. Utility.....	64.88	310.85	0.00	415.76
5. Tools and Materials.....	268.00	76.67	229.13	572.13
Total	9,896.47	6,833.49	3,263.37	23,488.31
PER TREATMENT UNIT (PAOT)				
Planning	.82	.94	.30	.76
Replacement Value of Facilities	111.20	43.99	23.80	45.03
Operation and Maintenance	35.65	8.08	12.74	9.10
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	6.32	2.38	1.45	2.85
- USFS budgeted.....	16.37	5.36	5.78	5.00
2. Contract.....	5.34	3.32	2.70	1.67
3. Vehicle.....	4.17	.68	1.31	2.28
4. Utility.....	.30	3.00	0.00	1.26
5. Tools and Materials.....	5.74	.62	2.38	1.70
Total	129.88	30.30	36.57	47.14
PER TREATMENT OUTPUT (RVD)				
Planning	.42	.20	.09	.06
Replacement Value of Facilities	12.76	14.20	1.92	4.11
Operation and Maintenance	.79	3.11	1.47	2.09
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	.19	1.20	.23	.46
- USFS budgeted.....	.40	.81	.71	1.08
2. Contract.....	.17	.60	.35	.09
3. Vehicle.....	.10	.44	.08	.41
4. Utility.....	.05	.07	0.00	.03
5. Tools and Materials.....	.13	.12	.13	.17
Total	13.27	17.48	3.47	6.08

Appendix Table 7. Standard Deviations Corresponding to Average Annual Costs of Passive Sites in the Northern Region (Table 7), 1980 (10%)

PER TREATMENT OPPORTUNITY (SITE)	Interp. Major	Interp. Minor	Observ. Site	Document Site
Annual Planning	32.10	32.89	18.99	0.00
Annual Replacement Value of Facilities	9,564.86	42,611.00	2,437.43	3,349.99
Annual Operation and Maintenance	3,365.83	2,094.34	494.26	1,013.84
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	2,432.45	548.38	96.73	271.93
- USFS budgeted.....	36.77	589.92	208.02	387.56
2. Contract.....	719.83	226.02	240.26	253.78
3. Vehicle.....	109.60	190.99	34.92	49.34
4. Utility.....	989.95	1.89	0.00	0.00
5. Tools and Materials.....	3,942.12	854.44	182.94	52.54
Total	13,006.52	45,923.43	2,335.83	4,355.37
PER TREATMENT UNIT (PAOT)				
Planning	.71	2.12	1.46	.40
Replacement Value of Facilities	13.86	364.15	89.49	107.03
Operation and Maintenance	22.82	54.12	19.65	32.43
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	20.27	34.60	2.32	9.06
- USFS budgeted.....	26.97	9.91	13.16	11.70
2. Contract.....	1.81	10.54	5.11	8.42
3. Vehicle.....	1.86	3.64	2.46	1.59
4. Utility.....	3.80	.09	0.00	0.00
5. Tools and Materials.....	20.67	12.93	.93	1.75
Total	37.39	70.20	90.83	138.39
PER TREATMENT OUTPUT (RVD)				
Planning	.02	.11	.03	.01
Replacement Value of Facilities	.82	19.53	5.50	3.83
Operation and Maintenance	.74	1.52	.46	1.14
1. Labor.....	NA	NA	NA	NA
- contributed and/or borrowed.....	.39	1.05	.08	.30
- USFS budgeted.....	.68	.35	.17	.44
2. Contract.....	.01	.32	.27	.28
3. Vehicle.....	.05	.15	.07	.05
4. Utility.....	.05	.05	0.00	0.00
5. Tools and Materials.....	.33	.10	.06	.06
Total	1.58	1.91	5.72	4.97

APPENDIX B: Definition of Experience (Development) Levels

Site Modification	Development and Experience Level	Recreation Experience
Minimal. Rustic or rudimentary improvements to protect site rather than provide comfort to users. Synthetic materials avoided. Subtle, minimal controls; no obvious regimentation. Informal spacing extended to minimize contacts. Motorized access not provided or permitted.	1	Primitive forest environment dominates. Rudimentary and isolated sites beyond the sight or sound of inharmonious influences. Maximum opportunity for experiencing solitude, testing skills, and compensating for the routines of daily living. User senses no regimentation, feels physical achievement to reach site is important.
Little. Rustic or rudimentary improvements to protect site rather than provide comfort to users. Synthetic materials avoided. Subtle, minimal controls; little obvious regimentation. Informal spacing extended to minimize contacts. Motorized access provided or permitted, primarily over primitive roads.	2	Near primitive forest environment. Outside influences present but minimized. Feeling of accomplishment associated with low-standard access is important but physical exertion not necessarily required to reach site. Opportunity for solitude and chance to test outdoor skills.
Moderate. Facilities equally to protect site and comfort users. Contemporary/rustic design of improvements using native materials. Inconspicuous traffic controls usually provided for vehicles. Roads may be hard surfaced and trails formalized. Development density: about 3 family units per acre. Primary access to site over high-standard, well-traveled roads. Visitor Information Services, if available, are informal and incidental.	3	Forest environment is essentially natural. Solitude is combined with some opportunity to socialize. Controls and regimentation for safety and well-being of user sufficiently obvious to afford a sense of security but subtle enough to leave the taste of adventure.

Site Modification	Development and Experience Level	Recreation Experiences
Heavily modified. Some facilities strictly for comfort and convenience of users but no luxury facilities. Facilities may incorporate synthetic materials. Extensive use of artificial surfaces for roads and trails. Traffic controls for vehicles present and usually obvious. Primary access usually over paved roads. Development density: 3-5 family units per acre. Plant materials usually native. Visitor Information Services frequently available.	4	Forest environment is pleasing and attractive but not necessarily natural. Blends opportunities for solitude and socializing with others. Testing of outdoor skills mostly limited to the camping activity. Many user comforts available. Moderate contrast to daily living routines. Creates marked sense of security.
High degree. Facilities, most for comfort and convenience of users, include flush toilets and may include showers, bath houses, laundry facilities, and electrical hookups. Designs may be formalized and architecture contemporary. Synthetic materials commonly used. Formal walks or surfaced trails. Regimentation of users is obvious. Access usually by high-speed highways. Development density: five or more family units per acre. Plant materials may be non-native. Formal Visitor Information Services usually available. Mowed lawns and clipped shrubs common. (EL5 sites are provided only in special situations or close to large cities where other lands are unavailable.	5	Pleasing environment attractive to the novice or highly gregarious camper. Opportunity to socialize with others very important. Satisfies urbanites' needs for compensating experiences and relative solitude, but less intensively than in classes 1-4. (User consciously in secure situation with ample provisions for personal comfort so will not be called upon to use undeveloped skills.)

Source: Abstracted from the USFS RIM Handbook.

APPENDIX C:

Questionnaire Forms Used for Activity Type and Interpretive Type Sites

Mont. E. of Divide ____

Mont. W. of Divide ____

N. Idaho ____

REGION ONE COST STUDY QUESTIONNAIRE
(VIS/Interpretive Type Sites)

Region 1, U.S.F.S., has contracted Oregon State University to conduct a study of the costs of providing developed recreation sites within the Region. This questionnaire is designed to help us collect necessary data for fiscal years 1979 and 1980.

Date _____

Site Name _____ Forest _____ District _____

Interp. Major _____ Interp. Minor _____ Interp. Admin. _____

Observation _____ Documentary _____ Information Site _____

Development/Experience Level: _____

Fee $ _____ Non-Fee _____

Total revenue collected from fees during 1979: $ _____

Total revenue collected from fees during 1980: $ _____

Number of RVD's for site in 1979: _____

Nimber of RVD's for site in 1980: _____

1. Were any temporary crews hired to perform maintenance, repair, or other labor at this site during 1979 or 1980? If so, how many hrs./day and for how many days did they work? What were their respective pay scales?

1979

	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1979 Total $ _____

1980

	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1980 Total $ _____

2. Did any seasonal staff perform operational or maintenance functions at this site in 1979 or 1980? If so, how many hrs./day and for what number of days did they work? What were their respective pay scales?

1979

	GS-7	GS-6	GS-5	GS-4	GS-3	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1979 Total $ _____

1980

	GS-7	GS-6	GS-5	GS-4	GS-3	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1980 Total $ _____

3. During 1979 or 1980, were any "borrowed" crews (ex., fire crews) used to perform maintenance or repair work at this site? If so, how many hrs./day and for how many days did they work? What would be their respective pay scales?

1979

	GS-6	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1979 Total $ _____

1980

	GS-6	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1980 Total $ _____

4. Did you or any other permanent district personnel spend time during 1979 or 1980 in connection with the operation and maintenance of this site? If so, what are the appropriate time periods and pay scales?

1979

	GS-11	GS-9	GS-7	GS-5	Other
no. of persons	____	____	____	____	____
hr./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1979 Total $ _____

1980

	GS-11	GS-9	GS-7	GS-5	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1980 Total $ _____

5. Were any jobs associated with this site (such as garbage collection or law enforcement) contracted out in 1979 or 1980? If so, what was the fee paid to the contractor?

Job	1979 Fee	1980 Fee

1979 Total _____

1980 Total _____

6. Did you or any other permanent district personnel accumulate any vehicle miles in connection with this site during 1979 or 1980?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

7. What would you estimate as the number of vehicle miles accumulated by seasonal and temporary crews working at this site in 1979 and 1980?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

8. What would be the estimated vehicle miles accumulated by "borrowed" crews during 1979 and 1980 in connection with this site?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

9. What are the listed annual depreciation costs for each of the vehicles used in connection with this site during 1979 and 1980? What percent of each year would you estimate that each of these vehicles was used in association with this site?

1979: Vehicle	Annual Deprec. Cost	Percent of Year	Cost
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____

1979 Total $ _____

1980: Vehicle	Annual Deprec. Cost	Percent of Year	Cost
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____

1980 Total $ _____

10. Were there any expenditures made for the usage of utilities such as electricity, gas, or water at this site in 1979 or 1980?

Utility	1979 Rate	1980 Rate	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

11. Were there any expenditures during 1980, such as repair or replacement costs, associated with tools used by crews or staff while working at this site?

Tool	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

12. What materials, if any, were used by crews on maintenance and repair activities during 1979 and 1980? (ex., paint, gravel, lumber, concrete, facilities replacement, etc.) What was the cost of these materials?

Material	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

13. Were there any expenditures, such as repair or replacement costs, connected with interpretive materials and equipment in 1979 or 1980?

Material	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

14. Were any interpretive materials distributed to the public during 1979 or 1980 at this site? If so, what was their cost?

Material	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

15. Was there any revenue received at this site in 1979 or 1980 other than from user fees? If so, for what was revenue received? What was the total revenue collected?

1979

Item	Unit Price	Quantity	Revenue
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1979 Total $ _____

1980

Item	Unit Price	Quantity	Revenue
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1980 Total $ _____

16. Were there any vandalism costs, not included in other questions, associated with this site in 1979 or 1980?

Item	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

General Information

Length of season: _____ to: _____

PAOT capacity: _____

Dist. to Route ____: _____

Elevation: _____

E Mont. & Dak. ____

Mont. E of Divide ____

Mont. W of Divide ____

N. Idaho ____

REGION ONE COST STUDY QUESTIONNAIRE

(Activity Type Sites)

Region 1, U.S.F.S., has contracted Oregon State University to conduct a study of the costs of providing developed recreation sites within the Region. This questionnaire is designed to help us collect necessary data for fiscal years 1979 and 1980.

Date _____

Site Name _____ Forest _____ District _____

Campground ____ Picnic Area ____ Boating ____ Swimming ____

Org. Camp F.S. ____ Group Campground ____ Group Picnic Ground ____

Development/Experience Level: ____

Fee $ _____ Non-Fee ____

Total revenue collected from fee during 1979: _____

Total revenue collected from fee during 1980: _____

Number of RVD's for site: (by activity)

	1979	1980		1979	1980
Camping	____	____	Hiking	____	____
Picnicking	____	____	Viewing	____	____
Fishing	____	____	Horseback Riding	____	____
Boating	____	____	Motorbiking	____	____
Swimming	____	____	Other	____	____
Waterskiing	____	____			

1979 Total RVD's _____

1980 Total RVD's _____

1. Were any temporary crews hired to perform maintenance, repair, or other labor at this site during 1979 or 1980? If so, how many hrs./day and for how many days did they work? What were their respective pay scales?

1979

	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1979 Total $ _____

1980

	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1980 Total $ _____

2. Did any seasonal staff perform operational or maintenance functions at this site in 1979 or 1980? If so, how many hrs./day and for what number of days did they work? What were their respective pay scales?

1979

	GS-7	GS-6	GS-5	GS-4	GS-3	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1979 Total $ _____

1980

	GS-7	GS-6	GS-5	GS-4	GS-3	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1980 Total $ _____

3. During 1979 or 1980, were any "borrowed" crews (ex., fire crews) used to perform maintenance or repair work at this site? If so, how many hrs./day and for how many days did they work? What would be their respective pay scales?

1979

	GS-6	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1979 Total $ _____

1980

	GS-6	GS-5	GS-4	GS-3	GS-2	Other
no. of persons	____	____	____	____	____	____
hrs./day	____	____	____	____	____	____
no. of days	____	____	____	____	____	____
pay rate	____	____	____	____	____	____
$	____	____	____	____	____	____

1980 Total $ _____

4. Did you or any other permanent district personnel spend time during 1979 or 1980 in connection with the operation and maintenance of this site? If so, what are the appropriate time periods and pay scales?

1979

	GS-11	GS-9	GS-7	GS-5	Other
no. of persons	____	____	____	____	____
hr./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1979 Total $ _____

1980

	GS-11	GS-9	GS-7	GS-5	Other
no. of persons	____	____	____	____	____
hrs./day	____	____	____	____	____
no. of days	____	____	____	____	____
pay rate	____	____	____	____	____
$	____	____	____	____	____

1980 Total $ _____

5. Were any jobs associated with this site (such as garbage collection or law enforcement) contracted out in 1979 or 1980? If so, what was the fee paid to the contractor?

Job	1979 Fee	1980 Fee

1979 Total _____

1980 Total _____

6. Did you or any other permanent district personnel accumulate any vehicle miles in connection with this site during 1979 or 1980?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

7. What would you estimate as the number of vehicle miles accumulated by seasonal and temporary crews working at this site in 1979 and 1980?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

8. What would be the estimated vehicle miles accumulated by "borrowed" crews during 1979 and 1980 in connection with this site?

1979: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1979 Total $ _____

1980: no. of trips _____ miles/trip _____

total miles _____ cost/mile _____

1980 Total $ _____

9. What are the listed annual depreciation costs for each of the vehicles used in connection with this site during 1979 and 1980? What percent of each year would you estimate that each of these vehicles was used in association with this site?

1979: Vehicle	Annual Deprec. Cost	Percent of Year	Cost
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____

1979 Total $ _____

1980: Vehicle	Annual Deprec. Cost	Percent of Year	Cost
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____
_____	_____	____	_____

1980 Total $ _____

10. Were there any expenditures made for the usage of utilities such as electricity, gas, or water at this site in 1979 or 1980?

Utility	1979 Rate	1980 Rate	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

11. Were there any expenditures during 1980, such as repair or replacement costs, associated with tools used by crews or staff while working at this site?

Tool	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

12. What materials, if any, were used by crews on maintenance and repair activities during 1979 and 1980? (ex., paint, gravel, lumber, concrete, facilities replacement, etc.) What was the cost of these materials?

Material	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

13. Was there any revenue received at this site in 1979 or 1980 other than from user fees? If so, for what was revenue received? What was the total revenue collected?

1979

Item	Unit Price	Quantity	Revenue
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1979 Total $ _____

1980

Item	Unit Price	Quantity	Revenue
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1980 Total $ _____

14. Were there any vandalism costs, not included in other questions, associated with this site in 1979 or 1980?

Item	1979 Cost	1980 Cost

1979 Total $ _____

1980 Total $ _____

General Information

Length of season: _____ To: _____

PAOT capacity: _____

Dist. to Route ____: _____

Elevation: _____

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